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"EROSIO" PORTIONIS VAGINALIS UTERI[1]

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IN spite of much work on this subject, there is no uniformity of ideas, as is well shown by the discussions at the Berlin Gynecological Society on the 8th of January and the 12th of February, 1909.

There are two views as to what an erosion of the portio really is. The main idea of the one is a disappearance of the upper layers and a change of the basal cells of the squamous into columnar epithelium. (Ruge and Veit.) The essence of the other is a loss of all the epithelium, which may, in the process of healing, be replaced by cylindrical cells.

There are many theories in regard to the origin of erosions, and I shall discuss briefly some of them.

The congenital origin may well come first in consideration. This theory was advanced by W. Fischel, who in his work (1879) wrote that these erosions can originate in a twofold manner.

"Either the epithelium of the surface is destroyed through external chemical or mechanical influences and the exposed mucosa becomes inflamed, or from some cause an inflammatory swelling of the mucosa precedes and leads secondarily through an extensive exudation to stretching, thinning and ultimate throwing off of the epithelium" (viii, p. 77). He wrote further: "My view as already expressed is, that in these cases it is a kind of ectropium, in the sense of a gradual change of the vaginal mucous membrane of the portio, it being gradually replaced by cells from the inflamed cervical mucous membrane" (viii, p. 90). In a later study he presents the results

Fig. 1. Obj. 3. Oc. 3. Tub. 20. Haemalaun. Diagnostic excision. An area at some distance from the erosion showing an extension of the round celled infiltration under the squamous epithelium and a death of the basal layer of cells.

Fig. 2. Obj. 3. Oc. 1. Tub. 20. Haemalaun. Uterus removed because of retroflexion with adnex-tumors and adhesions. This patient had a purulent vaginal discharge. Eversion was present and there was an "erosio glandularis" with marked round celled infiltration around the glands. The area shown is at some distance from the erosion and shows what might be interpreted as a beginning erosion caused by the inflammation and round celled infiltration excited by an infected gland.

Fig. 3. Obj. 1. Oc. 4. Tub. 15. Haemalaun. Showing two communications of a gland with the surface. Round celled infiltration though slight is present around the openings of the glands. At one of the orifices there is apparently a destruction of the basal squamous cells.

Fig. 4. Obj. DD. Oc. 3. Tub. O. Haemalaun. Drawing from an "erosio glandularis" which is healing. The basal cells are shown exposed as a form of columnar epithelium. This same preparation showed true cylindric epithelium on the surface.

Fig. 5. Obj. 3. Oc. 1. Tub. 15. Haemalaun and muci-carmine. Nullipara. Myomatous uterus. Shows the squamous epithelium growing under the cervical epithelium which shows the characteristic staining with muci-carmine.

Fig. 6. Obj. 1. Oc. 4. Tub. 16. Haemalaun and muci-carmine. Glandular cells show the characteristic staining reaction for mucin. The squamous epithelium has grown into the openings of the glands underneath their epithelium.

Fig. 7. Obj. 1. Oc. 4. Tub. 18. Haemalaun. Diagnostic excision. Squamous epithelial plug connected with the surface. Near it one sees a small cyst lined with low cylindrical epithelium.

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of his investigation of twenty-eight still-born and new-born children, among whom he found this congenital erosion in thirty-six per cent. He described his findings as follows: "The vaginal surface of the portio is covered with a mucous membrane of varying extent, running upwards from the region of the external os toward the vaginal vault; this (mucous membrane), not only on account of its single layer of columnar epithelium but also because of its less papillary structure and its possession of mucous secreting crypts and glands, must be considered as a direct continuation of the cervical mucous membrane" (ix, p. 196). It is also important to note that he says: "Where we found this surface in these new-born infants covered with squamous epithelium we saw no trace of glands of any description" (ix, p. 197).

One might ask why the above described congenital erosion may not disappear after, as well as before the birth of the child, leaving no traces of the columnar epithelium and the glandular formation.

The most essential part of his theory is presented by him in the following manner: "It must be admitted as possible that the erosions in adults are formed only when the affected individual carries over from an earlier period of development the necessary remnants for this" (ix, p. 200, Fischel).

Since portio and vagina originally had the same covering of columnar epithelium and similar glandular formations, one should find similar pictures in erosions which are not situated directly at the external os. Cases have been described in which glandular figures were seen in the vagina as well as on the portio. Such cases are however rare and can hardly be used to explain the ordinary erosion of the portio.

A second theory is that erosions are produced by acquired eversion or ectropium. (Tyler Smith in England and T. A. Emmet in the United States.) This, or a similar condition, had previously been briefly described by Roser. That cervical mucous membrane can occur upon the portio in the neighborhood of the external os cannot be denied and one can definitely say that the prolapsed and everted mucosa of the cervix corresponds anatomically with the picture described by Ruge, Veit and others as erosion.

The third much discussed theory of Ruge and Veit states that erosions originate in loco and that they do not owe their origin, at least not exclusively, to preformed glands and most important it presumes that after the loss of the upper layers of the squamous epithelium the basal layer, stimulated in some way or other, is changed into columnar epithelium, from which transformed epithelium glands are created. This constitutes the essence of the theory presented by Ruge and Veit, as is seen in the following quotation: "The glands are to be considered as arising from invaginations of this columnar epithelium and this itself from a change of the mother cells of the squamous epithelium into independent cylindric epithelium. The cervical mucosa, normal or pathological, is not really everted but the mucosa of the portio itself becomes glandular and can thus present the appearance of an eversion" (vii, p. 436). According to the same authors the final healing takes place in the reverse manner, that is, the columnar epithelium which originated from the basal layer changes itself again into squamous epithelium. The surface becomes covered and the newly formed glands are filled up with these transformed squamous epithelial cells.

A fourth class of theories called, according to the suggestion of C. Ruge, the perforation theories, was first put forward by Münzberger (1881) who writes: "Further it is not impossible that a gland grow through the portio from the inner surface of the cervix and make its appearance on the outer surface. If we examine preparations of portiones which have been amputated during pregnancy or the puerperium we shall get an idea of the growth energy of these glands. The columnar epithelium raises up the squamous epithelium and pushing itself underneath it, changes by rapid growth the form of the papillæ, and gives rise to an erosion" (ix, p. 34). Schottländer, who in part takes the standpoint of Ruge and Veit, in part that of von der Hoeven, believes he has proved that the glands perforate the squamous epithelium. He says: "I believe it to be possible for small glands lying under the basal layer of the squamous epithelium to form a

communication with it and by continual secretion form a path for an external opening. Occasionally a preceding vaginal inflammation may prepare a way for a rupture to the exterior." He thinks also that "such a preparation is not absolutely necessary, that much more a gland can, to all appearance, from active growth of its epithelium alone and at most with incidental assistance from leucocytes, make its way through the entire thickness of well preserved squamous epithelium" (iv, p. 8).

Gottschalk has written in a similar way: "That in spite of the fact that the basal layer of the squamous epithelium may remain, it never takes on the character of the cervical epithelium; however, his main idea is that the so-called erosion glands (erosio glandularis) do not arise from invaginations of the basal cylindric cell layer of the pre-existing squamous epithelium, but are in fact real cervical glands which grow from the inside of the lips outward and break through on the surface, after the squamous epithelium of the affected places has lost its power of resistance or has been cast off" (x, p. 920).

Apparently Gottschalk has put together two entirely distinct things, namely: a primary perforation through the epithelium; and an extension of columnar epithelium upon an already eroded surface.

He explains the loss of the squamous epithelium through (*a*) subepithelial hæmorrhage; (*b*) pressure by distended glands; (*c*) breaking through of glands or cysts and a substitution of outgrowing glandular epithelium for the atrophic squamous epithelium.

He believes further that the "erosio papillaris" arises in two ways, namely, through a rupture of a papillary cervical gland upon the surface of the portio and also by hyperplasia of the connective tissue cells with the formation of papillæ, which is stimulated by a marked hyperæmia and a strong growth of the limiting glandular epithelial cells.

In the discussion following Gottschalk's presentation R. Meyer emphasized the difficulty of differentiating the various stages of the erosion and ulceration. He held the theory of Ruge and Veit as not proved, remarking that erosions and ulcerations are more often observed in the stage of healing or covering over with columnar epithelium than when the epithelium is lost.

He remarked: "In all cases I hold that the loss of the squamous epithelium resulting from inflammation (infiltration and hæmorrhages in conjunction with maceration from the cervical secretion) is the essential point; only this is an erosion and the covering of the wound surface with columnar epithelium is the first stage in the healing of the erosion" (xxix).

Continuing he said that the epithelial covering can come from the margins of the erosion either on the portio or in the cervical canal, also from the eroded, preformed, inflammatory, or perforating glands. The different varieties of glands which may be present under the squamous epithelium of the portio can grow in various directions through the inflamed subepithelial tissue. The epithelium which grows out from the glands replaces the lost squamous epithelium of the surface, and constitutes the first stage of healing. The "erosio glandularis" and "papillaris" he considers as an excessive regeneration or hyperregeneration. R. Meyer remarked that he considered the superficial columnar epithelium as newly formed and not as autochthonous, as Ruge believes. The complete healing results when the cylindrical epithelium of the surface of the erosion as well as of the glands is supplanted by squamous epithelium growing in from the margins of the erosion.

C. Ruge in the discussion held to his theory and emphasized the idea that erosions originate in loco and that there is no relation between the cervix and the erosions of the portio.

In considering these different theories and studying the preparations some things have been impressed upon me, so before taking up the description of my findings in detail, I wish to call attention to a few points. One can hardly deny that there are erosions without an epithelial covering, and it would seem the simplest and best to consider this as the essence of "erosio portionis."

It is absolutely necessary for one to keep in mind that broadly speaking three stages can be recognized in erosions, namely, the beginning, the developed, and the healing; these three stages may occur in an erosion simul-

taneously. As one considers the theory of the origin of these erosions and sees a large number of specimens he is convinced that no one narrow theory explains them all.

The congenital remnants which Fischel found in thirty-six per cent and Dieterlen in only ten per cent of new-born children have nothing to do with the loss of the squamous epithelium, nor do they account for the round celled infiltration. It is perfectly possible to account for the presence of some of the glands under the squamous epithelium by the active growth of the cervical glands which extend deeply into the tissue even into the muscle of the cervix. The simple erosion has no glands and its origin can hardly be attributed to fœtal remnants.

Nor is it possible to explain all of the erosions as eversions for one sees erosions with no eversion present and eversions without any trace of an erosion. This theory explains neither the simple nor papillary erosion though it is perfectly reasonable to think that glands and cysts can be brought to the outer surface of the portio by an eversion of the lips. It seems fair to state that eversion and ectropium do not signify erosion but that they are often associated with and can in all probability be a factor in the formation of an erosion.

It seems that the theory of Ruge and Veit is not sufficient explanation for all the ordinary cases because the erosion as understood by them can be an erosion in process of healing, and it is important to note, that upon the surface two kinds of columnar epithelium occur, namely, those cells which come from the cervical epithelium and glands, and the other cells which are evidently left over from the basal layer of the squamous epithelium. These cells have an entirely different appearance from the cervical epithelial cells and very important to note is the fact that these two classes of cells have an entirely different staining reaction with muci-carmine. These different characteristics will be considered later in detail. Further, it is not established that the glands can originate from the transformed cells of the Rete Malpighii; they might be preformed or as we shall see they could be formed from cervical epithelium. And it is not proven that healing results from a change of the cylindric epithelium into squamous epithelium for it might be displaced and supplanted by the latter.

The perforation theory is not held as a sufficient explanation for all erosions even by its advocates. Schottländer speaks as does von der Hoeven of a continual struggle between the squamous and the columnar epithelium. It is rather to be viewed as a fight between the squamous epithelium and inflammatory processes. The cylindric epithelium which may cover the erosion will be supplanted by squamous cells as soon as the inflammation subsides. Squamous epithelium is never overcome by cylindrical epithelium but is destroyed by the inflammatory process.

It is not to be considered as a two-sided struggle between the two kinds of epithelial cells and one can at most speak of a one-sided struggle of the squamous epithelium against the columnar epithelium and never the reverse.

That the ordinary erosion arises from pressure by or breaking through of the glands or cysts, is difficult to prove and in my opinion explains the origin of very few erosions.

At the suggestion of Prof. R. Meyer I undertook the examination in serial sections of preparation from portiones in 57 cases. Among these there were eight specimens from pregnant uteri of the second to the fifth month and one from a puerperal uterus.

In five cases the entire portio and in the others a piece of tissue from one or both lips in the neighborhood of the external os, was sectioned and studied; in the portiones from pregnant uteri, as well as in some others, both lips were observed side by side.

Aside from the specimens obtained during pregnancy and the puerperium the series comprises six diagnostic excisions, five normal, ten abnormal portiones without erosion and twenty-seven with erosion.

The age of the patients varied from a new-born babe to a woman of 60 years. Of these thirty-five had either borne children or aborted, and in nineteen it is not stated; this leaves three in whom no pregnancy had taken place. Eleven complained of leucorrhœa, one had had gonorrhœa, and in the others no history of either was given.

The following outline will give a general

idea of the causes for removal in the various cases:

1. The diagnostic excisions were removed to decide a suspicion of malignancy.

2. The pregnant uteri were extirpated because of pulmonary tuberculosis.

3. The puerperal uterus was taken out because it was ruptured.

4. The others were removed on account of elongatio colli, prolapsus, myomata, inflammation and other diseases of the tubes and ovaries, endometritis, and metritis.

It seems advisable to consider briefly the findings in the pregnant uteri separately.

In these specimens from puerperal and pregnant uteri seven showed erosions, one had a healed erosion, and another presented none. Eversion was found six times in these preparations, twice without erosion.

It is seen that no entirely normal portio was found among these. The seven cases with erosions presented larger or smaller areas without the natural epithelial covering and showed a more or less intense superficial round celled infiltration especially marked under the newly formed squamous epithelium and the eroded surfaces. In three cases there was a striking infiltration near the glands and at times a larger or smaller number of round cells was seen under the old squamous epithelium.

Erosion glands (those in direct relation to the eroded surfaces) were found in seven portiones but only three times were they distended; in seven cases glands were demonstrable under the old squamous epithelium; distended glands or cysts were found in various locations eight times.

Single layered columnar epithelium on the surface had in no case any evident connection with the basal squamous layer but in three instances there was a single layered cylindric epithelium on the surface which had a direct connection with the glands.

The epithelium of the erosion glands often shows degeneration and apparently they are often destroyed during the inflammatory process.

Concerning the healing there is not much to be said, however, I found granulation tissue three times, newly formed squamous epithelium growing out from the edges of the erosion in four cases, and saw very often squamous epithelium growing into the glands underneath their epithelium, and indeed in one case the squamous cells were evidently growing into the cervical canal itself and raising the columnar epithelium in its own domain.

I wish to mention as especially important the differences in form and staining, especially with muci-carmine, between the cells of the basal layer of the squamous epithelium and those of the real columnar or cervical epithelium. These differences will be described in detail under another heading (Fig. 5, 6).

From the observation of these preparations one sees:

1. That erosions occur very frequently during pregnancy.

2. Certain things concerning the origin of erosions:

(*a*) Inflammation is constantly present and the infiltration shows itself often under the well preserved epithelium at some distance from and apparently independent of the erosion itself. One finds also necrotic squamous epithelium on the surface. These findings indicate that inflammation and infiltration may occur under the squamous epithelium before the surface is eroded (Fig. 1).

(*b*) The frequency of marked infiltration around the glands and their orifices indicates that the inflammation can originate in and spread from them (Fig. 2).

(*c*) The infiltration is often independent of the glands (Fig. 1).

(*d*) Glands are almost constantly present in erosions which are located near the external os but one is not justified in saying that erosions originate from pressure of these glands which do not always show distension.

(*e*) It is possible that occasional erosions originate from ectropium.

(*f*) The glands show very great growth during pregnancy.

(*g*) There are no proofs for the origin of erosions from casting off of the epithelial cells and laying bare the basal layer of the squamous epithelium.

3. That healing of the surface takes place by a growth of the squamous cells from the margins of the erosion.

It is to be noted further in regard to the

process of healing that the single layered columnar epithelium which occurs on the surface of the portio is nearly always true cervical or glandular epithelium.

That the squamous epithelium often overcomes the true columnar epithelium is evident from the manner in which it grows under and raises up the latter from the underlying connective tissue. One sees this very plainly in the sections stained with muci-carmine, in which the red stained mucin-cells are seen lying on the squamous epithelium of the surface as well as on that which has grown into the glands themselves (Fig. 5). In no case did I see mucin-cells under well preserved squamous epithelium but occasionally the columnar epithelium, was seen growing out from the glands upon the eroded surface which was partially covered with dead squamous epithelium which no longer had any connection with the underlying connective tissue. An apparent destruction of the squamous by a growth of the columnar epithelium underneath it was found in none of the cases. It appears that the cylindric epithelium takes possession of only those surfaces which are already eroded.

Granulation tissue has an important part to play in the healing of erosions and ulcerations.

The erosion glands disappear partly from necrosis during the inflammatory process and those which are left may disappear from the ingrowth of squamous cells which converts them into solid plugs of squamous epithelium or into cysts lined with squamous cells; these may later become flattened out even with the surface of the portio (Fig. 7).

The six *diagnostic excisions* showed various stages in the development and healing of erosions. In only one of these was carcinoma found. In all the others there were areas without an epithelial covering and in two there was ulceration present. There was old squamous epithelium present in all but in only one was there any newly formed squamous epithelium and in one other true columnar epithelium occurred on the surface.

In all of these specimens there was a diffuse or a localized round celled infiltration but in none of them was it particularly marked near the glands. It is however quite important to note that there was infiltration between the cells of the old squamous epithelium.

In two of the cases there were no glands in the eroded area or under the squamous epithelium and in the others there were no distended glands found in connection with the erosion. In two cases poorly preserved squamous epithelium was recognizable on the surface and in one the basal layer was the first to die. This in my opinion points to a primary cause operating under the squamous epithelium and not to a change of the character of the epithelium, neither to eversion nor casting off of the superficial epithelial layers as the essential causes of erosions.

One might further conclude that inflammation and round celled infiltration play the principal part in the origin of erosions.

From these preparations one is certainly not justified in concluding that the erosions were caused by pressure from distended or perforating glands, and evidently the congenital factor is not essential to the development of an erosion.

From the remaining preparations I will first describe briefly five apparently normal portiones.

One specimen showed a very small area of round celled infiltration under the well preserved squamous epithelium; there were no glands present near this infiltrated area. In two cases there were no glands or cysts present under the squamous epithelium; in another case the cervical canal near the external os was covered with squamous epithelium in which the glands opened; in another a cyst without an external opening was present under the epithelium of the portio, and in the fifth there were both glands and cysts present. In all of these cases the glands lay under the squamous epithelium close to the external os and in only one instance had they grown deeply into the tissue of the cervix.

For the sake of comparison with the processes on the portio I studied a piece of tissue from a prolapsed vagina and found an area with the basal layer of the vaginal mucous membrane exposed; there was no infiltration present nor were any glandular formations found; neither had the cells of the basal layer taken on any of the characteristics of the true columnar epithelium.

Of the ten cases without erosions there were six with eversion. Two specimens, one with an eversion, showed apparently healed erosions. In two others, there were very small areas which appeared to be very early stages in the development of an erosion.

In the remaining twenty-seven cases all of which had erosions there were twenty which showed eversion. These erosions were located at the external os except in two instances, when they were at some distance from it and showed neither glandular formations nor true columnar epithelium on the surface. There was a complete loss of the surface epithelium in only one case, all of the others showing larger or smaller areas which were denuded of their epithelium.

Newly formed squamous epithelium was growing from the margins over the erosion in thirteen and six of these showed low columnar epithelial cells on the surface which were in connection with the basal layer of the squamous epithelium. This kind of superficial cylindric epithelium never shows any direct connection with the glands, has a form differing decidedly from that of the cervical epithelium, and distinguishes itself from the latter by not staining with muci-carmine.

In fifteen instances true columnar epithelium extended from the glands or cervical canal upon the surface.

The following distinguishing characteristics between the real columnar epithelium and that originating from the mother cells in the basal layer of the squamous epithelium have been noted. The real cervical epithelium stains constantly with muci-carmine while the basal cylindric epithelium does not show this reaction (Fig. 5, 6). The former is always in connection with the glands or the epithelium of the cervical canal but the latter is independent of both glands and cervical epithelium and usually shows a connection with the squamous cells. It is rare for the cervical epithelium to show a tendency to form more than one layer but the basal epithelium has a quite constant and marked inclination to build several layers. The first is much more regular in the size, form, and arrangement of its cells than the latter. The cells of the real columnar epithelium are much larger, have relatively smaller, thinner, and more roundish nuclei than the cells of the basal epithelium and the nuclei are located more noticeably toward the base of the cells in the first than in the second form (Fig. 4, 5).

Infiltration is constantly present in the eroded area; in sixteen of the specimens it was very marked around the glands and especially at their openings in the squamous epithelium; the round cells are often numerous under the newly formed squamous epithelium and the infiltration quite frequently spreads out under the old squamous epithelium. Usually the infiltration is only superficial but in a few of the preparations it extended quite deeply into the tissue. Two of the cases showed small isolated erosions on the portio which appeared to have very recently broken through the squamous epithelium. In one of these the infiltration was around a gland but in the other it was entirely independent of any glandular formation.

In the two erosions which were isolated on the portio at some distance from the external os there were no glands nor was there any true columnar epithelium on the surface. These observations seem quite important when considering the various theories regarding the origin of erosions as both of these were apparently of inflammatory origin.

In the rest of the cases glands or cysts were almost constantly present; it is however well to note in this connection that these erosions occurred near the external os. I saw atrophy of the epithelium, with apparent erosion formation, from pressure of an enlarged and distended Nabothian follicle, only once.

Twelve of the cases with erosion glands showed distended and fifteen undistended glands. In a few cases cysts or ectatic glands with two and in one case with three communications with the surface, were found; this of course indicates that they can form new connections with the surface or that two or more glands can grow together. Both of these possibilities seem to me about equally probable (Fig. 3).

In all of the cases with erosions there were glands under the squamous epithelium and only seven of them showed no distended glands or cysts. They occur more frequently under the newly formed squamous epithelium in which they open more frequently than in the

old. This tends to show that as the epithelium becomes older the glandular openings disappear, and that the underlying glands diminish in number. Another fact which points strongly to this conclusion is, that one often sees relics of former openings and quite frequently real communications with the surface. In this same connection it may be mentioned that distended glands occur more frequently under the old than under the new squamous epithelium, although one sees cysts in the cervical canal itself. The glands lying under the old squamous epithelium may be undistended or unequally distended, forming cysts of varying sizes. It is not uncommon to find cysts lined with squamous epithelium and occasionally one sees solid plugs filled with these cells. The squamous epithelial cysts sometimes have a content which stains with muci-carmine. This fact points to the conclusion that they were previously lined with mucin-producing cells. The columnar and low epithelial cells of the ordinary cysts always stain with muci-carmine but the squamous cells never take this stain properly.

It occurs quite frequently that glands grow out from the region of the external os sometimes to quite a distance under the portio epithelium and more or less parallel to its surface. This is, of course, important in connection with the perforation theories but is also of great importance in explaining the occurrence of glands under the squamous epithelium of the portio.

Newly formed squamous epithelium was found only twice in the cases without erosion; the surface of the others was completely covered with old squamous epithelium. In this connection it may be well to describe the differences between the new and the old squamous epithelium. The papillæ of the new are less marked and not so regular as those of the old epithelium. The cells appear more delicate and do not stain as strongly in the former as in the latter. The new basal cells appear larger and not so regularly arranged as the old ones. The cells of the outer layers have relatively larger, more uniformly round bodies than the older ones, which become markedly flattened especially nearer the surface.

Five of the nine specimens without active erosions showed round celled infiltration and in four of these it was most marked around the glands. This is important to note because it points to the glands as harborers of a latent infection which may flare up and produce an erosion (Fig. 2). Two of four preparations with healed erosions presented small infiltrated areas which were breaking through the squamous epithelium. Glands were found under the squamous epithelium in all of these cases; they were often distended even to cyst formation and showed both real and relics of former openings in the squamous epithelium. Glands opening through the squamous epithelium were found near the external os in the portiones removed from a young child and a girl. These facts point of course to a persistence of glands under the squamous epithelium as emphasized by Fischel and could account for the presence of at least some of the glands which characterize the so-called "erosio glandularis."

After a brief consideration of the various possibilities in connection with the questions arising from a study of this problem I shall endeavor to draw a few conclusions from the material that has been investigated by me during the past year.

In regard to the causation of these erosions one has to consider the congenital erosion or ectropium as described by W. Fischel.

Further one must mention the mechanical injuries which may arise from operations, etc., from abortions or labors; it must not be forgotten that these injuries may cause subsequent eversion and it is also important to remember that in inflammatory conditions with marked swelling of the cervical mucosa and especially in the softening of the tissues and shortening of the cervix incident to pregnancy there may be a more or less marked prolapse of the cervical mucous membrane. As a mechanical factor, may be mentioned the atrophy of the epithelium caused by pressure from distended glands or cysts.

Chemical causes may operate on the portio through the use of douches or direct application, also by the maceration of the epithelium by a normal or pathological cervical secretion.

As an all important cause must be considered the inflammation which may result from an infection arising in some way or other.

It is necessary to seek for an explanation of the findings which occur on the surface. In reference to the eroded areas one may say that it is possible for them to arise from abrasion, including maceration, from pressure atrophy, and from the death of the epithelium due to some inflammatory process or other. The presence of the columnar epithelium may be accounted for in various ways, namely: a persistence of the columnar cells on the portio in the neighborhood of the external os; a prolapse or eversion of the cervical mucosa so that it comes to lie on the outer or vaginal surface of the cervix; an outgrowth of cells over a denuded area from the glands or cervical canal; a change of the basal cells of the squamous epithelium into real columnar epithelium; naturally these basal cells might persist as a kind of low cylindric epithelium. The question of the source of the newly formed squamous epithelium may be answered in various ways. It is possible that it might come from a change of these basal columnar cells into squamous epithelium or as a growth from indifferent mother cells; it is not at all difficult to think of them as coming from islands of squamous epithelium which have remained undestroyed on the surface or around the openings of glands; lastly, no one would doubt the possibility of their coming from the margins of the erosion which are lined with squamous cells.

Round celled infiltration is unmistakably present in nearly all of the cases and the main questions to decide with reference to it are whether it originated, primarily, before or after the loss of the superficial epithelium and where it started. It might extend from the surface inward or it might originate under the surface epithelium in the glands or in the blood or lymph vessels.

The explanation of the origin of the glands in erosions has caused a great deal of strife and the following possibilities have been considered: Preformed or congenital glands (Fischel); invaginations of the surface columnar epithelium whether the true or basal form (Ruge. Veit); the overgrowth or outgrowth of cervical glands under the epithelium of the portio (Münzberger, Schottländer, Gottschalk and others); the carrying outward of cervical structures by misplacement and eversion as a result of cervical tears and from prolapse of the cervical tissue, (Smith, Emmet and others).

A papillary erosion might originate from an excessive growth of the connective tissue, from a too strong proliferation of the columnar epithelium, or from a breaking through upon the surface of a markedly papillary gland.

Some of the possibilities in connection with the process of healing have been touched upon and will be only mentioned under this heading. One must consider granulation tissue as a factor in the ultimate healing of some of these erosions and ulcerations; the occurrence of the basal and true columnar epithelium on the surface has already been discussed as one of the most important and most disputed questions in the entirepr oblem. The occurrence and possible origin of squamous epithelium from remaining islands of cells, from a change in the character of the epithelium, from mother cells, and from the margins of the erosion has been touched upon. For the perfect ultimate healing it is necessary that the glands under the portio epithelium disappear completely. One can conceive of this as happening in various ways. The glandular cells may disappear from a necrosis due to the inflammation. Squamous epithelium may grow into the glands and throw off the columnar cells and fill up the lumen more or less completely. The cysts which are lined with squamous epithelium might originate in this way or the cells might come from a change in the character of the columnar epithelium which usually lines the cysts; it is of course possible that the squamous cells might originate from indifferent mother cells.

It is rather difficult to draw definite and exact conclusions in such a study as this as any opinions must, to a certain extent at least, have more or less of a personal equation in that conclusions are in reality only impressions created by the observation of the specimens studied. I have tried to eliminate impressions and any bias as much as possible in this matter.

1. Pregnancy seems to be a very important factor in the development of erosions because they occur so frequently in that condition.

2. The labor with its attendant injuries gives a splendid chance for infection and the development of an erosion.

3. Inflammation is the most important factor in the origin as well as the extension of the erosion; all of the other things are accessory. Round celled infiltration precedes the formation of an erosion as is proved by the following observations: such infiltration occurs in cases without erosions under the squamous epithelium either superficially or around the glands; infiltration is found under well preserved epithelium in healing and healed erosions and one sees an apparent recurrence of an erosion beginning at the infiltrated area. There are many other facts to be noted in this connection. It is important to remember that glands are especially susceptible to infection and certainly the intensity and frequency of the infiltration around their orifices is very striking, therefore one recognizes the glands as especially important for the origin and extension of the infection under the superficial epithelium. Infiltration occurs independently of the glands so they cannot be regarded as the exclusive source of the infection. The inflammatory origin of these erosions is suggested by the observation that the younger erosions show the most marked infiltration. As an important proof of the extension of erosions by inflammation must be mentioned the fact that infiltration and necrosis spread out under the old squamous epithelium and that such epithelium when it is undermined by this infiltration dies and is cast off.

4. The basal layer of the squamous epithelium appears to be the first of the epithelial layers to die as a result of the underlying inflammation (Fig. 1). This points quite definitely to a cause working under the epithelium, and while many other factors may enter into the formation of an erosion this one certainly cannot be ignored.

5. Hæmorrhages under the epithelium are often associated with the inflammatory process and this raises it from its supporting tissue and helps in throwing it off.

6. There are two distinct kinds of columnar epithelium which may occur on the surface. One is the basal columnar epithelium and the other is the real or cervical type of epithelium. They have nothing to do with each other so far as origin or ultimate fate is concerned.

7. The newly formed squamous epithelium extends outward from the margins of the erosion over the denuded surface. It is perfectly reasonable to expect that it might come from epithelial islands or from mother cells, but I was not able to find proof of this.

8. The glands under the squamous epithelium and under the erosion originate from various sources. They may come from glands which were normally present in the individual which includes those of congenital origin. The outgrowth of glands under the squamous epithelium of the portio accounts for some of them; this is especially noticeable in the softened tissue of the pregnant uterus or in that softened by inflammation. The altered relations of tissue brought about by eversion and cervical tears bring glands to the vaginal surface of the cervix. I was entirely unable to find any proof for the formation of glands by invaginations of the surface covered with columnar epithelium either of the cervical or the basal type.

9. Cysts arise from the shutting off of outgrowing glands or from a stopping of their openings with squamous epithelium.

10. In one case I saw papillary outgrowths from the surface which were partially covered with columnar epithelium. In another case I saw a marked papillary growth in the lumen of a gland but it had not broken through to the surface. My very limited observation of this form of erosions which is called the "erosio papillaris" points to their origin and development from a hyperregeneration primarily of the connective tissue.

11. The process of healing is accomplished by the growth of granulation tissue. It is noticeable that, irrespective of its type, epithelium has a tendency to cover over a denuded surface and it is because of this power that we find the erosion covered with the most accessible form of epithelium. This would very frequently be columnar epithelium because of the nearness of the glands and the cervical mucosa to erosions which are most commonly found near the external os. It appears also that the cylindric epithelium has the power of growing more rapidly than the squamous

epithelium. On the other hand the squamous epithelium has greater powers of resistance, and growth though slower is more persistent. It is in this way that the surface ultimately becomes covered with the squamous cells.

12. The glands disappear in various ways and first may be mentioned the necrosis which occurs during the inflammatory process. The growing in of the squamous cells and destruction of the glandular cells is proved by the frequent occurrence of newly formed squamous cells under the cylindrical cells at the mouth of the glands (Fig. 5, 6) also by the occurrence of older glands with columnar epithelium on only one side while the rest of the lumen is almost completely filled with squamous cells. One sees solid plugs of squamous epithelium which show more or less intact communications with the surface (Fig. 7) and the occurrence of the squamous epithelial cysts is not at all infrequent.

Finally I wish to state that erosions are chiefly inflammatory processes showing pictures which vary with the stimulus to their formation, and the reaction of the tissue. The congenital or acquired peculiarities of a healthy though anatomically not entirely normal portio may modify the appearance of an erosion very much. The complete and ultimate healing results when the glands are filled up with squamous epithelium and become smoothed out even with the surface which is covered by squamous cells originating from the mother cells already present on or near the erosion.

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SOME EXPERIMENTS ON OMENTAL ADHESIONS

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INTRODUCTION

EXPERIMENTAL investigation has dealt with the absorptive, adhesive, and exudative properties of the omentum, with its vascularizing functions, and with the microscopic changes in the organ in its altered states. But no detailed study of the microscopic alterations of the adherent omentum has been made. At operations, on the autopsy table, and in experiments the omentum has been found adherent in every part of the abdomen. Thus Adami,[1] in a large series of post-mortem observations, found adhesions of omentum to the various abdominal viscera were remarkably common. Eccles[2] pointed out that, in pathological conditions, the omentum, and especially its lower border is apt to be found near the seat of inflammation. In searching the literature, we have been unable to find any mention of the especial parts of the omentum concerned in the formation of adhesions.

About two years ago one of us began to observe the adhesions of the omentum to be seen at the operating table. Since then omental adhesions, fresh and old, have been observed in every quadrant of the abdomen. *Old* adhesions were seen extending to viscera, hernial sacs, and laparotomy scars. In most instances these occurred in the form of broad or narrow projections that were, apparently, prolongations of the lower, free border of the omentum. We can not recall any case in which the anterior or posterior surfaces of the omentum were involved to the exclusion of the free border. In the early stages of acute inflammatory disease *fresh* adhesions of the free edge of the omentum were seen; in later stages, however, the omental surfaces as well as the lower border were often broadly adherent to inflammatory foci. As observations on the operating table are necessarily very incomplete, we decided to perform some experiments on the omentum of rabbits in order to attempt to ascertain the roles played by different portions of that organ in adhesion formation.

[1] Adami. Canadian Practitioner, March, 1898.
[2] Eccles. St. Bartholomew Hospital Reports, 1894, xxx, p. 81.

ANATOMY

The healthy rabbit's omentum is a very delicate membrane that springs from the greater curvature of the stomach and the first half-inch of the duodenum and is situated in front of the large and small intestines. Unlike the human omentum, the layers of peritoneum do not enclose the transverse colon. On the left side they entirely envelop the spleen, which is a true intra-omental organ. The extreme portion is derived from the duodenum and is deeply seated. The whole omentum is comparatively short, and as it is attached for the greater part of its origin to the stomach—a somewhat fixed organ—it is relatively limited in its possible field of excursion. Thus it is impossible to draw the omentum into the lower third of the abdomen. The omentum may be said to have an anterior and a posterior surface (the rabbit in the dorsal position), a left and a right border, and a lower border. The latter will be designated the "edge." We will employ the term "edge" to include the immediately contiguous surfaces of the omentum. It is very thin and is often delicately scalloped. The left border, descending from the cardia, is not well defined. Inasmuch as the edge gradually approaches the duodenum from left to right, the right border of the omentum is very short The amount of fat situated between the layers of the omentum varies considerably, but is usually slight. The only macroscopical blood-vessels usually present are those in the splenic region. Occasionally a few are scattered throughout other parts of the srgan.

TECHNIQUE

The technique of our experiments was very simple. The laparotomies were painlessly

performed under local anæsthesia.[1] Careful aseptic precautions were observed, wet sterile gloves being worn. The abdominal contents were handled as little as possible. When portions of the omentum were to be resected, the organ was spread lightly over the gloved finger and sections were excised with small sharp scissors. Vessels had to be clamped in only a few instances. The cut portions of the edge could always be recognized at subsequent examinations by a delicately beaded line of blood clot. The average length of the abdominal incision was four centimeters. The incisions were always closed in layers. Most of the rabbits were subjected to a single laparotomy; in some cases, however, successive laparotomies were performed in order to observe progressive changes in the omentum. Immediately after the operation, the rabbits hopped about in lively fashion and showed no signs of shock or pain.

The results of our investigations are given below; they were arrived at by often repeated experiments, but we shall cite only a few characteristic ones:

EXPERIMENTS WITH INTACT OMENTUM UNDER ASEPTIC CONDITIONS

A. Foreign bodies were implanted in different portions of the abdomen. When foreign bodies such as lead shot were merely dropped into the abdomen, they promptly fell into the pelvis. For example:

Experiment 1. March 8th: Median hypogastric incision. With the guidance of the finger small lead shot was placed directly over the left kidney. Another shot dropped into the right side of the abdomen. *Examination*, March 10th: Lead shots adherent to each other, covered by exudate, and lying free in bottom of pelvis. Small portion of omentum edge adherent to space between two sutures at upper angle of wound. Portion adherent drawn out in form of tongue; deeply congested, and firmly attached.

We ascertained that the rabbit's omentum would not become adherent to foreign bodies in the lowest third of the abdomen, thus:

Experiment 2. March 15th: Median suprapubic incision. In front of bladder small shot was sutured to parietal peritoneum on one side of the incision, similarly a small plate on the other side. *Examination*, March 17th: Bladder greatly distended. Prevesical fat adherent to foreign bodies. Omentum normal.

In various experiments aseptic foreign bodies were sutured: to the parietal peritoneum of the left and right half of abdomen as high as the under surface of the diaphragm and as low as a short distance above the bladder level. As illustrative cases:

Experiment 3. March 12th: Median epigastric incision. Small perforated plate sutured to parietal peritoneum 3 cm. to left of incision. *Examination*, March 13th: Omental edge adherent, 1, to laparotomy wound; 2, to a small peritoneal defect (probably made in suturing peritoneum) to the right of the incision; 3, to the plate. A part of the left half of the edge was the only part of the omentum adherent. Each adhesion deeply congested and thickened. Plate entirely surrounded; through perforation in its center a delicate prolongation of omentum passed along the suture that fixed the plate to the abdominal wall and followed the suture to parietal peritoneum. The portion of edge adherent to laparotomy wound sent tiny tongues of omentum through several of the interspaces between peritoneal sutures, to become adherent to the fasciæ. Omentum taut between stomach and abdominal wall. Stomach rotated forwards 90 degrees to accommodate omental adhesions at this high level.

Experiment 4. March 24th: Median incision midway between sternum and pubis. Small button sutured against parietal peritoneum 5 cm. to right of incision (by carrying thread through the whole abdominal wall on a long straight needle). *Examination*, March 25th: From right half of edge tongue-like protrusion about 4 cm. long, surrounded, and was firmly adherent to button. Was intensely congested and thickened. Stomach markedly rotated to the right.

Experiment 5. March 29th: Incision in right hypochondrium. Liver punctured with a small hook; wound oozed freely. *Examination*, March 30th: Omentum adherent to incision by prolongation of right half of its edge. Several tongues dissected between sutures. Same congestion and thickening of adherent parts as above. Marked rotation of the stomach to right. No free blood in peritoneal cavity; was all found in the form of small clots in and near the omental edge.

Experiment 6. March 17th: Incision in right hypochondrium, starting at costal margin. Small lead plate suspended from under surface of diaphragm by short thread; latter fixed to diaphragm by a Michel clamp. *Examination*, March 19th: Broad tongue from right half of the edge firmly adherent to and surrounding plate. Small part of the edge adherent to upper angle of incision. Omental surface in broad contact with anterior and superior surfaces of liver but nowhere adherent. Marked forward rotation of stomach. Congestion and thickening of adherent portions of omentum as in previous experiments.

[1] For this purpose 1 cc. of 1 per cent solution of cocaine was employed. In rare cases there was evidence of pain, when the local was promptly supplemented by general anæsthesia. We had frequent opportunity to observe that, as Meltzer and Kast have shown, the injected cocaine apparently acts as a general as well as a local analgesic.

In all of the cases in this group of experiments the omentum became adherent. In every case the adhesions extended from its edge and from this alone. The adhesions were tongues or prolongations of the edge, varying in length and width according to the distance and size of the foreign body. In every experiment the adhesion was deeply congested — numerous vessels running in the long axis of the adhesion being seen where none had been visible before. The vascularity of the adherent portions gave them a deep red color that sharply differentiated them from the surrounding pale gray omentum.

In this group of experiments we frequently observed the remarkable tendency of the omental edge to attach itself to raw areas, no matter how small, to work its way through the smallest gaps (as those between the peritoneal sutures and those made by the needle in suturing the peritoneum), and to pass through the finest holes in the foreign bodies.

B. The omental edge became adherent to denudations of visceral or parietal peritoneum in the same manner. No matter how small the area denuded, a congested prolongation of the edge became adherent to it. In no case was any other part of the omentum attached. A striking example:

Experiment 7. March 26th: Median epigastric incision. Small bits of parietal peritoneum removed at three points: 1, 4 cm. to right of incision; 2, 3 cm. to left of upper angle of incision; 3, 4 cm. to left of lower angle. *Examination,* March 27th: Middle portion of edge adherent by four prolongations, three to the denuded area, the fourth to the laparatomy. From the latter several offshoots passed through the layers of the abdominal wall, between the sutures. The adhesions to the peritoneal denudations resembled those to foreign bodies — the same vascularization, thickening of attached portion, tongue-like shape, etc. Stomach rotated forward 90 degrees. No adhesions; the omental edge between the four points of attachment, although the edge between the adhesions was in contact with parietal peritoneum.

C. Whenever the omentum becomes adherent to foreign bodies or to peritoneal denudations, the adhesion is only by a varying portion of the edge, as indicated above. The remainder of the edge is ready to adhere to new foreign bodies or to new raw areas. This was seen in a number of experiments in which second laparotomies were performed several days after the first.

D. If several denudations are made, or foreign bodies are implanted far apart, the omental edge becomes adherent to them and not to the interspaces. Experiment 7 will serve as an illustration.

E. Although our experiments do not deal with the absorptive qualities of the omentum, we may mention that, in a number of experiments associated with intra-abdominal hæmorrhage, blood clots were only found in or near the omental edge (as an example see experiment 5).

F. When the omental edge becomes attached to points well beyond the normal site of the organ, the stomach follows its excursion. In some of the cases the stomach was rotated as much as 90 degrees on its horizontal, and 60 degrees on its vertical axis. The rotation on the horizontal axis was especially marked when the the omentum traveled in a direction opposite to that of gravity to become attached, as to the under surface of the diaphragm.

G. It has already been shown that the rabbit's omentum has one physical limitation — it cannot stretch into the pelvis. A further limitation is present when the omentum is so fixed by an adhesion of a part of its edge that the remainder cannot reach a foreign body, raw area, etc. The latter, under such circumstances, become covered by a fibrinous exudate. To illustrate the observations summarized in sections *F* and *G:*

Experiment 8. March 22d: Mid-abdominal incision. Button sutured to parietal peritoneum to left of incision. Omentum not seen during operation. *Examination,* March 23d: Button adherent to parietal peritoneum by thick fibrinous exudate. Omentum not seen. Stomach rotated backward at least 90 degrees. On lifting stomach omentum seen adherent to foreign body lying behind and above lesser curvature — adhesion of broad, highly vascularized portion of the edge which evidently drew the remainder of the omentum along. The omentum is in intimate contact with, but not adherent to, posterior surface of stomach. Foreign body proved to be a small coprolith escaped from descending colon. (In the rabbit the lower colon begins in a curve behind the lesser curvature of the stomach, and coproliths sometimes escape from this portion of the intestine.)

H. The omental adhesions covered *all* peritoneal defects as well as all foreign bodies

within reach. We have seen many illustrations of this statement,—some of the above described experiments will serve as examples.

I. When the edge adheres to a foreign body, the latter is completely encapsulated by this portion of omentum. Such encapsulation occurred in every experiment.

J. Congestion of the adherent part of the edge was seen in every case. Usually there were numerous fine vessels running the length of the adherent tongue, generally along its borders.

K. The omental edge never became adherent by a macroscopically visible exudate. To peel free the adherent edge more effort was required than in separating the ordinary adhesions — as those between loops of intestine and those of omental surfaces (see below) — forming in one to three days.

L. This series of experiments demonstrated an additional point: the part of the omental edge which becomes adherent is that nearest the foreign body or peritoneal denudation.

EXPERIMENTS WITH RESECTED OMENTUM

A. Inasmuch as the edge plays such a very important part in aseptic omental adhesions, the first series of experiments in this group dealt with resection of portions of the edge.

If a portion of the edge is removed and a foreign body is implanted, adhesions will extend to the foreign body from the intact part of the edge and not from the excised portion. This was demonstrated by a number of experiments. For example:

Experiment 9. April 1st: Mid-abdominal incision. Narrow strip of the left three-fourths of the edge removed in one piece. Slight bleeding. Abdominal wall closed in layers. *Examination*, April 3d: Long delicate adhesion to upper angle of wound. Came from right (uncut) part of edge. Remainder of latter not adherent, not rolled up.

Experiment 10. April 12th: Incision in right hypochondrium. Left and middle third of edge resected in one piece. *Examination*, April 16th: Median incision. Right (uncut) part of edge broadly adherent to the length of the first incision. Button then attached to parietal peritoneum 3 cm. to left of median incision. *Examination*, April 20th: Button plastered against parietal peritoneum by exudate. No adhesion to it. Part of edge adherent to first incision very firmly attached. Cut edge showed no tendency to become adherent.

B. Even when large portions of the edge are excised, leaving only small isolated areas of intact edge, the latter alone become adherent to foreign bodies or to denuded areas. As an example:

Experiment 11. May 21st: Median epigastric incision. Two long strips of edge resected, leaving three small areas of intact edge — one in the median line and two at the extreme right and left portions. Two small denudations of parietal peritoneum made 3 cm. on either side of the abdominal incision. *Examination*, May 24th: Long, narrow adhesion to right denudation from extreme right (uncut) part of edge. Delicate adhesion from central (uncut) portion of edge to laparotomy wound. Left denudation covered by exudate. The adhesion of same nature as those above described. No adhesion of the cut portions of the omentum. Stomach rotated forward nearly 90 degrees.

C. In a number of experiments conditions were made very favorable for adhesions from the excised part of the edge, as in this experiment:

Experiment 12. April 5th: Median epigastric incision. Narrow strip of the left seven-eighths of the edge removed in one piece. A button suspended from the abdominal wall by a half-inch thread attached to the left of the incision. This enabled the omentum in the region of the cut edge to come in intimate contact with the button when the animal assumed its normal posture. Peritoneum on the colon, to right of incision, pinched with forceps. *Examination*, April 7th: Button and suture are held in contact with parietal peritoneum by a fibrinous exudate. Long narrow adhesion from right (uncut) part of edge to small area of large intestine. No other adhesions.

In not a single experiment did the omentum adhere by its denuded parts; in every instance it was the intact portion of the edge (and only this portion of the omentum) that became adherent.

D. In order to avoid the trauma incident to resection of a portion of the edge, the latter was excluded by carefully coating it with a thin layer of sterile collodion. The results were the same, thus:

Experiment 13. April 29th: Incision in left hypochondrium. Omentum drawn out and edge carefully painted with thin layer of collodion from left to right as far as the edge was accessible. Button suspended by a short thread from the abdominal wall 3 cm. to the left of the incision. Examination, May 3d: Button free. No adhesion from collodionized edge. Very long thin adhesion coming from the extreme right portion of the edge was adherent to the incision.

E. The blood supply to the omental edge was partially cut off by the ligation of several vessels passing to it from the stomach. This had no effect on the formation of adhesions by the omental edge.

F. The blood, lymph, and nerve supply to the omental edge were in large part cut off in this experiment:

Experiment 14. April 21st: Median epigastric incision. A large "window" was made in the omentum by excising an area extending from the right border to the spleen and from a short distance below the stomach to 1 cm. above the edge. The edge was thus completely detached except at two points — one near the right border and one near the spleen. Button attached to parietal peritoneum to left of incision. *Examination,* April 23d: Edge adherent to button and to upper part of abdominal incision by separate prolongations of same nature as the adhesions previously seen. Loop of intestine adherent to lower part of incision.

Their exclusion had no effect on the formation of adhesions by the edge.

G. The entire omental edge, as far as accessible, was excised in a number of experiments. (It has been pointed out that the extreme right portion of the edge is almost always inaccessible without considerable trauma.) In none of the cases did the cut margin become adherent; but very often an adhesion extended from the far right (intact) part of the edge. In none of the cases did other parts of the omentum become adherent.

H. To completely exclude the omental edge it was entirely coated with collodion. The results were the same as those of group *G.*

In all of these experiments the condition of the omentum was examined from one to four days after operation. Inasmuch as we believed that the cut omental edge, like any raw peritoneal area, might become adherent after a longer period, we performed some experiments of the following nature:

Experiment 15. May 21st: Median epigastric incision. Strip of the edge completely removed. Abdominal wall carefully closed — peritoneum by everting suture (see below). *Examination,* June 2d: Through incision to the left of the first; omentum not adherent. A button sutured to one side of the incision. *Examination,* June 4th: Button adherent to parietal peritoneum by exudate. Omentum not adherent.

In five experiments of this group the omentum was examined from twelve to fifteen days after operation. In three cases (of which the above quoted is one) there were no adhesions; in two cases the cut edge was adherent in whole or in part. In the latter the adhesions were attached to the nearest loops of intestine (which were not knowingly abraded or wounded). The following experiment was performed in the case in which the omentum was only partly adherent:

Experiment 16. September 20th: Edge completely resected. *Examination,* October 5th: Cut margin firmly adherent at two points — upper part of incision and loop of large intestine. Each adhesion was about 1.5 cm. wide. Between the two adhesions a large central part of the cut edge was not adherent. Button sutured to parietal peritoneum so that, with the animal in normal posture, the non-adherent part would be near it. *Examination,* October 8th: No adhesion to button.

To summarize the results: The raw omental margin may become adherent a certain length of time (probably a week) after excision of the edge. Such adhesions occur independently of peritoneal denudations or foreign bodies. In the cases in which the raw margin did not become adherent, it did not adhere to a foreign body implanted in favorable situations. The omental surfaces did not show adhesive qualities for fifteen days after the edge was removed.[1]

THE OMENTUM IN INFLAMMATORY CONDITIONS

All of the former experiments were performed under aseptic precautions. In a few cases, however, infection occurred, and we then had the opportunity of observing the behavior of the omentum under such circumstances. The omental edge (when present in these cases) adhered to the diseased area, and the adjoining surface of the omentum was spread over and was adherent to the focus by a visible exudate. As an instance:

Experiment 17. May 7th: Left epigastric incision, traversing a milk duct. Omental edge collodionized. Small denudation of parietal peritoneum to left of incision. *Examination,* May 10th, through a median wound. No adhesion of omentum. Collodionized edge resected. *Examination,* May 17th: Pus oozing from wound. Purulent exudate in wound bulging into peritoneal cavity. Anterior omental surface down

[1] The work on this group of experiments is incomplete because nearly all the rabbits became emaciated and somewhat apathetic from five to eight days after removal of the edge. Whether this was accidental or in some way associated with removal of the edge we cannot say. The post-mortem findings did not indicate any cause for the changed condition of the animals.

to and including the edge broadly adherent to bulging mass by a thick fibrino-purulent exudate. Part of the omentum was plastered over and adherent to neighboring loops of intestine in same way.

When a mild form of infection was experimentally induced, the omental edge alone became adherent to the diseased area:

Experiment 18. September 23d: Mid-abdominal incision. A large end-vessel in the transverse mesocolon was divided between ligatures, and transverse colon was freed from mesocolon for 2 cm. The isolated intestine became collapsed and flabby. *Examination*, September 25th: The diseased piece of intestine was intensely infiltrated, œdematous, party imbedded in a thick exudate. Opposite the mesenteric border a very deeply congested prolongation of the omental edge was attached. When the adhesion was freed a serosal defect on the colon remained. No other omental adhesions.

When, however, a severe infection was induced, the omental surface became broadly attached by a thick exudate. This occurred even when the edge was excised, thus:

Experiment 19. October 2d: Five centimeters of transverse colon freed by same procedure as that employed in previous experiment. Then a strip of omental edge removed from left border to the right as far as accessible. *Examination*, October 4th: Partly necrotic intestine surrounded by an inflammatory exudate to which the surfaces of the omentum were broadly adherent. Cut edge indistinguishable in the mass of omentum and exudate.

A PERITONEAL SUTURE BASED ON OBSERVATION OF OMENTAL ADHESIONS

Attention has been called to the remarkable tendency of the omentum to become attached to the smallest peritoneal denudation, and to work its way through the smallest peritoneal gap. The great frequency of omental adhesions at the site of a laparotomy scar — often the cause of severe pain, gastric symptoms, intestinal obstruction, etc., — has given rise to numerous attempts at their prevention. These have included applications of oil, mucilage, thiosinamine, etc., which have been for the most part unsuccessful.

Early in our experimental work we observed the frequency with which the omental edge became attached to the gaps between the peritoneal suture and even to the perforations of the parietal peritoneum made by the small needle employed. Later we attempted to obviate these complicating adhesions by more carefully applied sutures, but were only partly successful. Adhesions although fewer in number, still appeared in most of the cases.

The following method of peritoneal suture, on the Czerny-Lembert principle, was therefore employed: Beginning at one angle of the wound a half-curved needle is introduced in the axis of the wound a short distance below the cut margin of the peritoneum. The needle grasps peritoneum (and transversalis fascia) broadly. It is similarly passed beneath the opposite margin of peritoneum and the suture is tied. This everts the margins of the peritoneum and makes a broad apposition between peritoneal surfaces. The suture is passed down the length of the incision in the same way. The result is that the cut margins of the peritoneum (and transversalis fascia) are turned outwards and a broad approximation of peritoneum to peritoneum is obtained. In none of the six laparotomies in which we used this method did the omentum become adherent to the incision. We found the technique easy of application and the suture of considerable strength — it did not tear out when the animal strained (as occasionally happened in the ordinary method). Furthermore, there was no possibility of wounding viscera with the point of the needle.

RECENT ADVANCES IN THE TREATMENT OF NEPHROLITHIASIS[1]

By DANIEL N. EISENDRATH, M. D., Chicago, Illinois
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THE marked improvement in the operative treatment of renal and ureteral calculi is, in no small measure, to be ascribed to the general employment of more refined methods of diagnosis. The divisions of the main subject of renal calculi in which the writer has been particularly interested during the past few years are (1) the value of radiography in the diagnosis of renal calculi; (2) the frequency of occurrence of bilateral calculi and their relation to calculous anuria; (3) the importance of the newer work in the surgical anatomy of the kidney; (4) the choice of operation for removal of renal calculus, i. e., pyelotomy or nephrotomy.

1. *Value of radiography.* A few years ago one would be inclined to consider Kümmell's dictum, "no shadow, no stone," as too radical. The percentage of positive results (i. e., shadow present and calculus found at operation) is so large at the present time that such a statement does not seem an exaggerated one. The only exceptions to such an apparently dogmatic statement are the pure uric acid stones which either give very faint or no shadows.

In order to obtain such a large percentage of positive results, certain conditions are essential. First, the radiograph must be taken by one who has had a large experience in this special field. Radiography of the urinary organs has made rapid strides since the introduction of the Albers Schönberg compression apparatus. Although equally good pictures are obtained by some very expert radiographers without such an apparatus, still far more uniformly accurate pictures have been secured through its more general employment.

It is beyond the scope of this article to discuss the technique of taking such pictures further than to state that we employ the compression apparatus in all of our work.

Second, both kidneys and both ureters should be included in every picture. It is our routine practice at the Michael Reese Hospital to take a first picture covering both kidneys and the upper portion of each ureter, and a second picture, which includes both lower ureters and the bladder. The importance of such a bilateral exposure is referred to later.

In a good picture one can distinctly see the position, the outline, and the number of calculi. When the kidney is in its normal position, the stone shadows lie between the eleventh rib and a line drawn through the transverse lumbar vertebra. In a kidney which lies lower than normal the shadows will be found in a corresponding relation to such a dystopic position.

A kidney radiograph is best examined when dry and placed in a "diagnostic box." The use of an opera glass or powerful lens will be found of great service. A long twelfth rib (Fig. 2) may hide a stone shadow unless the plate is carefully studied. A calculus lying at the outlet of the renal pelvis usually has a nipple-like projection, which is so characteristic that when found opposite the transverse process of the first or second lumbar vertebra one can readily remove it through an incision into the pelvis, provided no other stone shadows are present.

Stones in the parenchyma usually have small, round, or oval shadows. When calculi lie in dilated calyces or in hydro- or pyonephrotic cavities, the shadows are quite large and oval.

When the shadow is triangular or branched, one can diagnose a large calculus occupying a greatly dilated pelvis. If a number of widely scattered shadows are seen, extensive destruction of the kidney has usually taken place. The majority of calculi belong to the mixed types and cast shadows of equal intensity sufficiently deep to be readily detected.

Third, the patient should be thoroughly purged and kept upon a diet of tea and broth for eighteen hours prior to the taking of a kidney or ureteral picture. In this manner one can exclude shadows due to scybala or other

[1] Read at the annual meeting of the Western Surgical and Gynecological Association at Omaha, December 20, 1909.

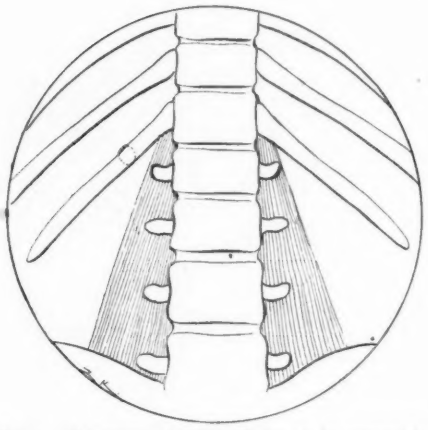


Fig. 1. Diagrammatic view of area to be covered by a skiagraph of both kidneys and upper portion of the ureters. The circle behind the twelfth rib shows the shadow of a calculus lying in front of this rib.

foreign matter in the bowels. In addition to the latter, one must differentiate shadows due to kidney calculi from those cast by calcified retroperitoneal and mesenteric glands, centers of ossification in the costal cartilages, and caseous tuberculous foci in the kidney. These can be excluded by one experienced in the interpretation of such radiographs.

2. *Bilateral calculi.* Unfortunately, but few statistics exist which are of value in determining the relative frequency of the simultaneous presence of calculi in both kidneys or both ureters. That such a condition occurs far more often than was formerly believed is shown by the fact that in a recent paper by Kümmell, of Hamburg, reporting 101 cases of renal calculi, they were present on both sides of sixteen patients, i. e., nearly sixteen per cent. In his book on Renal Surgery, published in 1901, Israel states that renal calculi occur upon both sides in twenty-seven per cent of his cases. I have been unable to find any more recent statement of Israel's experience in this direction. Kapsammer found bilateral calculi in five out of a total of twenty-eight cases of nephrolithiasis operated upon in von Frisch's clinic. He also found that in 73 cases of nephrolithiasis, examined during autopsies in the Pathological Institute of the General Hospital at Vienna, the calculi occurred in both kidneys in twenty-two cases, i. e., thirty per cent. The latter figure corresponds with the estimate of Watson, based upon 231 cases of renal calculi reported by Legueu, Albarran, Israel, Morris, and Kümmell. Watson found that the number of cases in which the calculi existed bilaterally, was thirty per cent. I have been able to collect twenty-six cases from recent literature. To this number can be added three occurring in the Michael Reese Hospital during the past year, in patients of Dr. L. L. McArthur, Dr. Braunwarth, and the writer, making a total of twenty-nine cases (Fig. 13).

Reference has been made in the section of X-rays technique to the necessity of including both kidneys in the radiograph. In many of these cases of bilateral calculi the pain is either constantly unilateral or shifts from one side to the other in a most confusing manner.

It is not only in order to avoid the reproach from the patient of having neglected to examine both kidneys for calculi that the surgeon must be informed as to the unilateral or bilateral presence of the calculi, but the danger of sudden anuria is far greater in bilateral than in unilateral nephrolithiasis.

Anuria occurred in six of Kümmell's fourteen cases, and four of these died, showing the gravity of the prognosis in bilateral cases. One of Watson's cases died of anuria, and in one of Cabot's two cases anuria appeared upon the eighteenth day after the first nephrotomy. Such an anuria is usually due either to the sudden bilateral closure of both ureters or to the obstruction of one ureter, with reflex anuria of the opposite kidney. It is the writer's belief that many cases of calculous anuria will in the future be found to be due to the former cause (bilateral calculous obstruction) than to the second-named cause (unilateral obstruction with reflex anuria of opposite kidney).

3. *Recent advances in the surgical anatomy of the kidney.* As the number of operations performed upon the urinary organs increases, it becomes more and more important for the surgeon to be familiar with every new detail in the anatomy of these structures. Those which require special mention in connection with the surgical treatment of renal calculi are (1) abnormalities of form and development and position of the kidney; (2) abnormalities of the vessels, pelvis, and ureters.

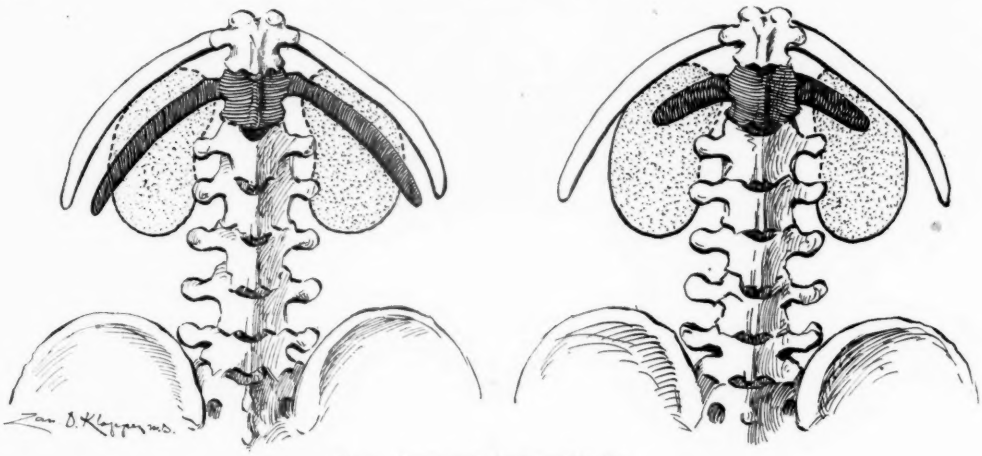


Fig 2. Long and short twelfth ribs.

Under the head of the former are included: (*a*) Solitary kidney, i. e., only one kidney is present; (*b*) horseshoe or fused kidney; (*c*) lack of development of one kidney, or hypoplasia. An excellent example of the importance of recognizing a hypoplasia is shown in Fig. 3, and was described in a recent paper by the writer. (*d*) Dystopia, or congenital displacement of the kidney. Such organs are either at the level of the sacroiliac joint or in the pelvis. Fig. 4 shows a radiograph of calculi in such a dystopic kidney.

Other anatomical points to be borne in mind in connection with operative work upon the kidney are anomalies of the renal arteries, i. e., accessory arteries and variation in the types of renal pelves.

Accessory renal arteries. The importance of the knowledge of the existence of more than one renal artery arising from the aorta cannot be overestimated. In compressing the pedicle of the kidney to check hæmorrhage during a nephrotomy for the removal of renal calculi or in ligating the pedicle during a nephrectomy one can easily overlook an accessory artery. Bleeding from such a vessel may prove very annoying during a nephrotomy or it may be torn off and a serious, if not fatal, post-operative hæmorrhage result. After ligating the main renal vessels during nephrectomy, ignorance of the presence of accessory arteries may in a similar manner cause serious hæmorrhage.

Practically no reference is made to this important anatomical point in books on anatomy or surgery, although Israel and some other writers mention cases of almost fatal post-operative hæmorrhage from this cause. The statement in the majority of books on anatomy is that a single renal artery arises from each side of the aorta to supply the corresponding kidney, dividing at or within the hilum into several branches. (Fig. 5.)

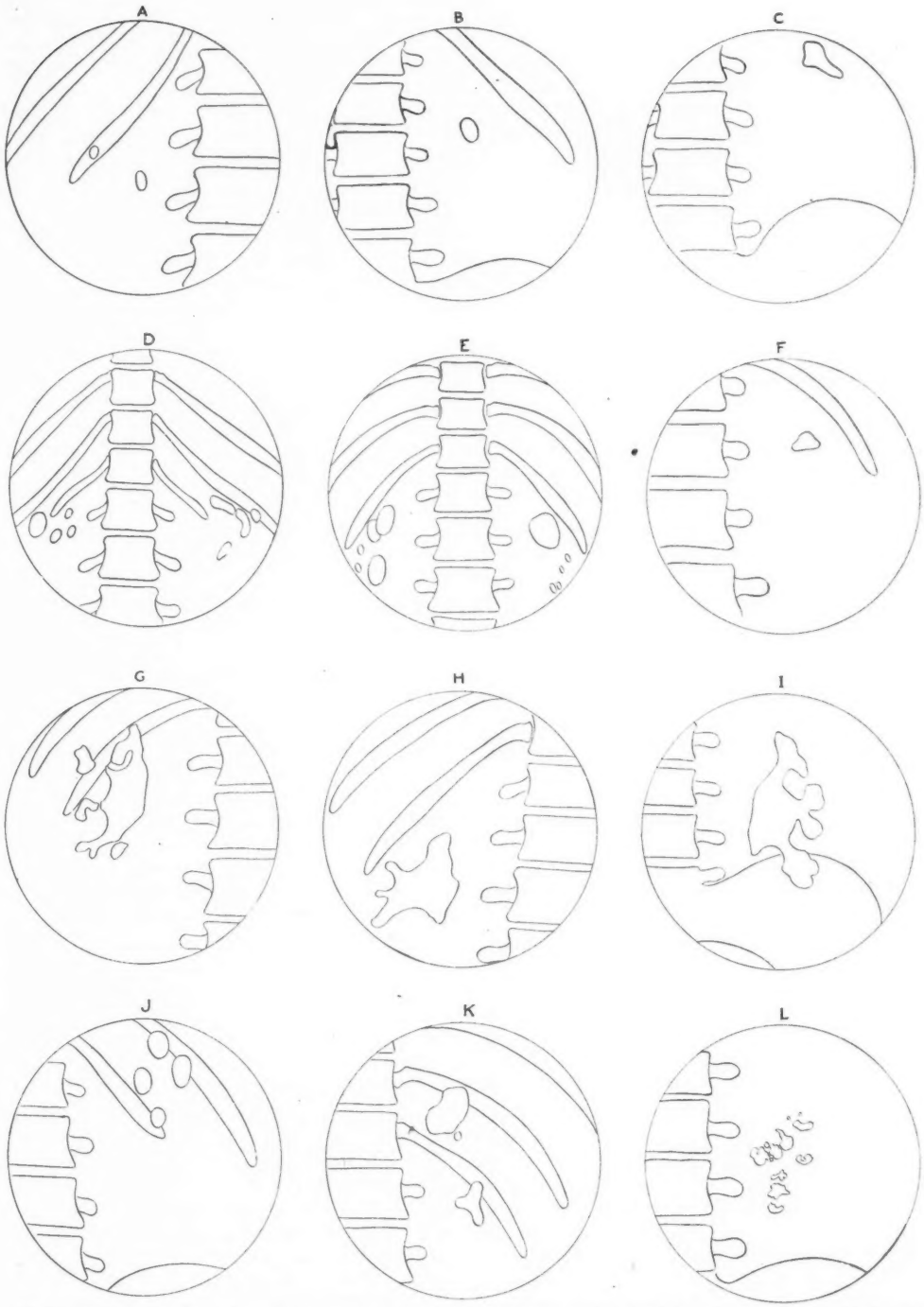
My associate, Dr. D. C. Strauss and the writer have recently begun the observation of the frequency of such anomalies in a large number of cadavers, but the work is not sufficiently advanced to permit of a report at the present time.

The most recent article upon these accessory arteries is by a Russian surgeon, Seldowitsch. In an examination of 150 cadavers, he found an abnormal number of renal arteries in 43, i. e., 30.5 per cent.

There may be either two or three renal arteries arising from the aorta. The double renal artery was present twenty-eight times on the left and twenty-five times upon the right side.

The manner of distribution of the accessory arteries to the kidney is shown in Figs. 6 to 9 inclusive, some of which were taken from our specimens.

(*a*) One artery to hilum and the other to the upper pole. (*b*) One to upper angle of hilum



Figs. 3 and 4. Tracings of renal skiagraphs. A, calculus shadow at outlet of pelvis and a second lying behind the twelfth rib. B and C, calculi lying at outlet of pelvis. D and E, bilateral calculi. F, nipple-like projection of calculus lying at pelvic outlet. G and H, coral-like calculi filling entire pelvis of kidney. I, coral-like calculus lying in dystocic kidney (just above crest of ileum). J, K, and L, multiple calculi lying in pyonephrotic kidneys. I am indebted to Drs. Greensfelder, Braunwarth, Reichman, McArthur, and Kahlke for permission to reproduce several of the tracings.

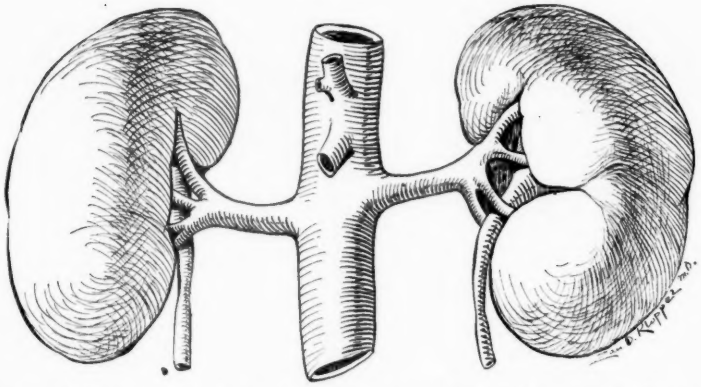


Fig. 5. Normal renal arteries. A single trunk arises from aorta and divides close to hilum. Note retropelvic branch upon left side.

and the other to center of hilum. (*c*) One to lower angle of hilum and the other to the center of hilum. (*d*) One to lower pole and the other to hilum. (*e*) One from aorta and the other from the iliac artery. (*f*) Three separate renal arteries arise from the aorta upon each side.

These accessory vessels may arise from all parts of the abdominal aorta, or even from the iliac arteries.

In nephrotomy one has most to fear from accessory arteries passing from the aorta to the upper or lower pole. To avoid these one should incise the poles as little as possible.

In nephrectomy it is always advisable to look for an accessory artery before ligating the pedicle.

After nephrectomy such an accessory artery passing to one of the poles may be torn off and serious hæmorrhage occur before the source is discovered.

A knowledge of the presence and relative frequency of these accessory arteries will be found to be of considerable importance to the surgeon.

Types of renal pelvis. The impression that only one type of pelvis exists is erroneous. This is also of great importance to the surgeon in connection with the operation of pyelotomy for the removal of calculi in the renal pelvis.

There are, in general, two types of pelves: (*a*) The classical ampullary type, i. e., a large sac occupying the entire hilum without division into large primary tubes. It is a wide sac from which a number of short primary tubes (or calyces) are given off, into each of which the apex of a renal cone or papilla opens to permit the urine to escape into the pelvis of the kidney. In such a type of pelvis, which occurs in about 30 per cent of cases (Delbet and Mocquot), a calculus can be easily found through either a pyelotomy or nephrotomy incision. (*b*) The ramifying type of pelvis. This is the more frequent form and the different varieties are shown in Fig. 12. The most common form is the bifid, i. e., the ureter expands, as soon as the kidney hilum is reached, into the pelvis of the kidney. This is relatively small and divides into two or three large primary calyces, i. e., the bifid or trifid type of pelvis. In the case of more frequent bifid type, one large tube leaves the pelvis at an oblique angle and receives the urine from the upper half of the kidney, through a number of secondary tubes or calyces proper, while the other tube runs transversely and after dividing into a number of secondary tubes or calyces receives the urine from the lower half of the kidney. In the trifid pelvis (Fig. 12) the three primary calyces receive the urine from the upper, middle, and lower thirds respectively. The importance of these recent anatomical investigations lies in the fact that in some cases it is necessary to combine a nephrotomy with a pyelotomy, in order to find a calculus. It is superflous to add that after dilatation of the pelvis or destruction of the pa-

renchyma from the presence of calculi, such pelvic relations are of no value.

If the radiograph shows more than one calculus, or if one wishes to be absolutely sure not to overlook a calculus hidden in the parenchyma or in a dilated calyx, a nephrotomy, laying the kidney wide open after the manner of an autopsy, is the only safe method. The incision is usually made a little behind the midline of the convexity of the kidney.

Relations of vessels to pelvis. A knowledge of the relations of the renal vessels is essential in the performance of a pyelotomy, i. e., opening the pelvis to extract a calculus. The renal artery and vein lie on the anterior aspect of the pelvis. Both divide into branches at this point and from the artery a retropelvic branch arises, which arches across the upper border of the pelvis, to pass across it to the kidney proper (Fig. 11). By making an incision into the posterior aspect of the pelvis one can avoid all vessels except the relatively small retropelvic artery, hence this side is the one to be chosen for pyelotomy.

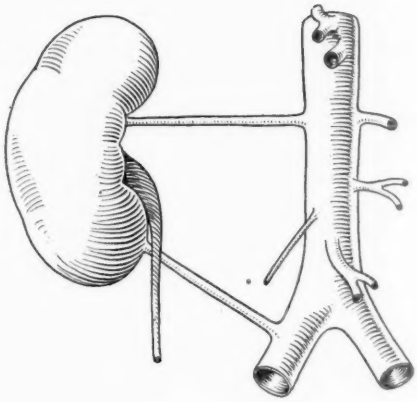
Effects of compression of renal vessels on the kidney parenchyma. Dr. D. C. Strauss and the writer are at present making a series of experiments upon animals to determine the effect of compression of the renal vessels upon the parenchyma of the kidney, such as is made during nephrotomy for renal calculi. The results of the microscopical examinations will be published in a later paper, but so far we have found that marked macroscopic changes follow compression, lasting over half an hour.

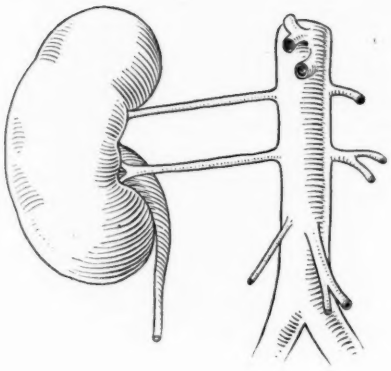
4. *Choice of operation.* The questions which confront the surgeon after the diagnosis of renal calculi has been confirmed by a radiograph are: Can a conservative operation, i. e., nephrotomy or pyelotomy, be performed, or should the entire kidney containing the calculi be removed? These two questions can only be answered by a consideration of certain preliminary data, which every operator must possess. The first requisite is that one must know the working capacity of each kidney, obtained through the use of the ureteral catheter and the most reliable tests of the functional capacity of a kidney. It is beyond the scope of this article to describe the technical steps of these tests, and it will suffice to say that, although the various procedures, cryoscopy, use of indigocarmine and of phloridzin, were at first regarded as almost infallible by the advocates of the individual tests, we have now reached the stage where most reliance is to be placed upon the chemical and microscopical examination of the urine obtained separately from each kidney, taken in conjunction with the indigocarmine and phloridzin. The latter two can only be regarded as of relative value, since it has been found by recent observers that the phloridzin test can prove negative in perfectly healthy kidneys as well as in unilateral disease. On the other hand, it can be positive when both kidneys are diseased; hence one cannot draw any conclusions from the negative results as to the pure functions of the kidneys, nor conclude anything regarding the healthy condition from the positive results. A kidney whose parenchyma is to a great extent destroyed does not excrete any sugar. In unilateral diseased kidneys, if the phloridzin test is at all positive, the diseased kidney excretes a less amount of sugar than the healthy one.

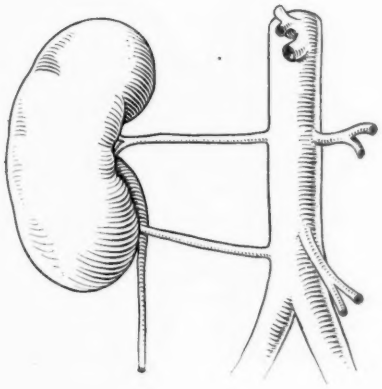
The only absolutely safe method would be to expose both kidneys before performing a nephrectomy, but even then one cannot rely upon palpation to determine whether a kidney will functionate. But few surgeons have as yet the courage to do this, so that we must depend upon the urinary examination and phloridzin tests for the present.

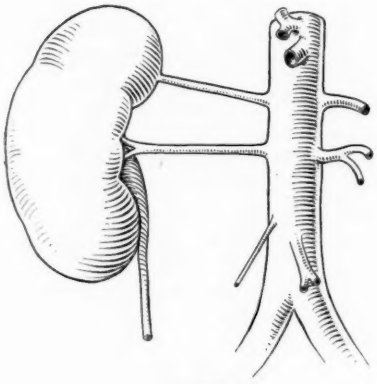
The second requisite is to know whether to choose extraction of the calculus through an incision through the posterior aspect of the pelvis (pyelotomy), or to enter the pelvis through an incision through the convexity of the parenchyma (nephrotomy).

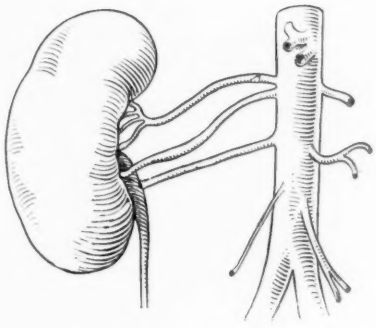
Whether pyelotomy or nephrotomy shall be performed depends upon (*a*) the condition of the urine and of the kidney, (*b*) upon the location of the calculus, and (*c*) the type of pelvis. Nephrotomy is always indicated in infected cases, when the urine contains pus or is ammoniacal, or there are gross pathological conditions in the kidneys, such as pyelonephritis or pyonephrosis. Pyelotomy can only be considered in aseptic kidneys. If the pelvis is small and entirely intrarenal, i. e., if it is of the bifid or trifid type, spoken of above, pyelotomy











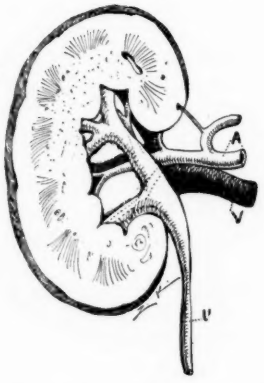


Fig. 6. One renal artery to hilum and an accessory to lower pole arising from iliac.

Fig. 7. Two separate renal arteries arising from aorta and entering hilum of kidney.

Fig. 8. Main renal artery enters hilum, and accessory artery passes from aorta to lower pole.

Fig. 9. Main renal artery enters hilum, and accessory artery from aorta to upper pole.

Fig. 10. Three renal arteries, each arising separately from aorta.

Fig. 11. Posterior view of relation of vessels to renal pelvis (Albarran). A, renal artery. V, renal vein. U, ureter. Note that pelvis is free on posterior aspect except for retropelvic artery (in dotted outline).

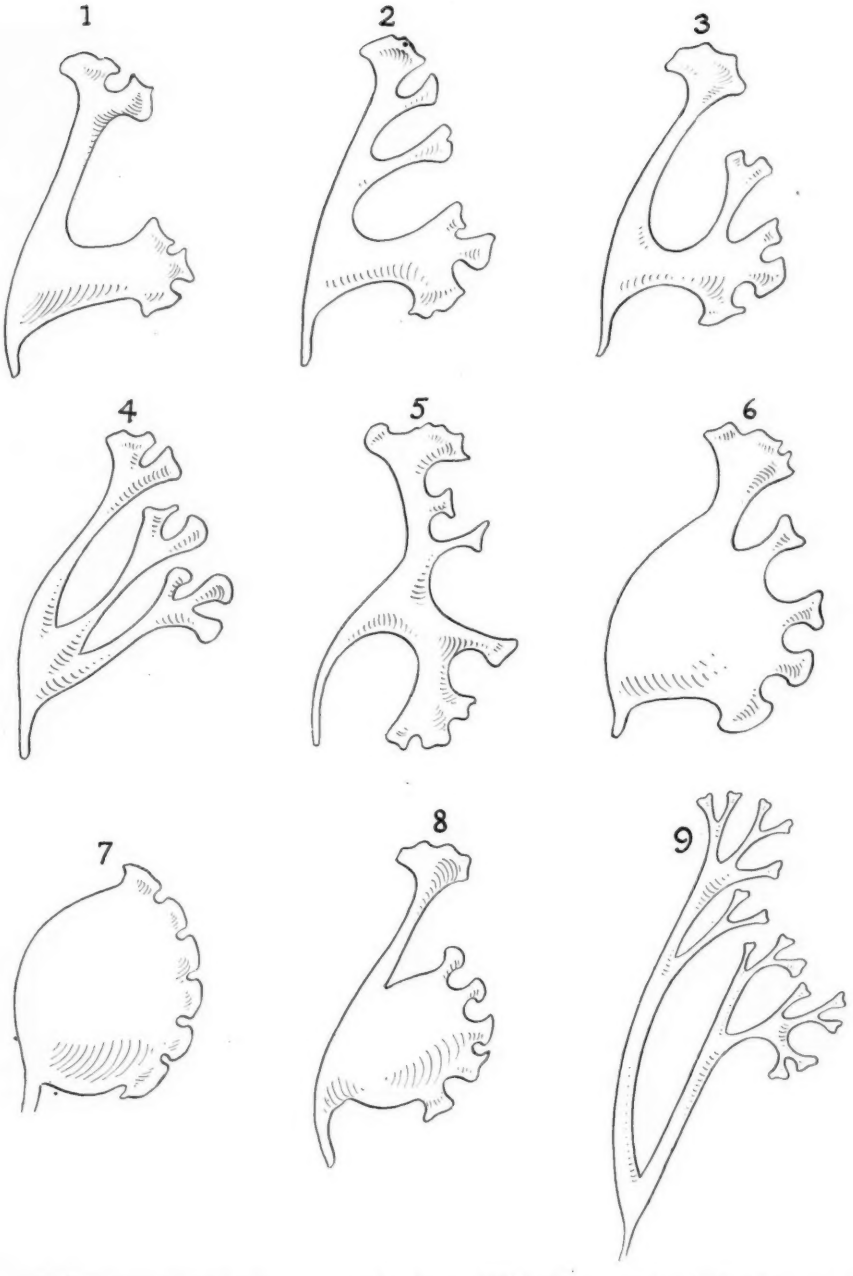


Fig. 12. Various types of renal pelves. 1, 2, and 3, forms of bifid pelves. 4 and 5, trifid pelves. 6, 7, and 8, ampullary forms. 9, unusual bifid type.

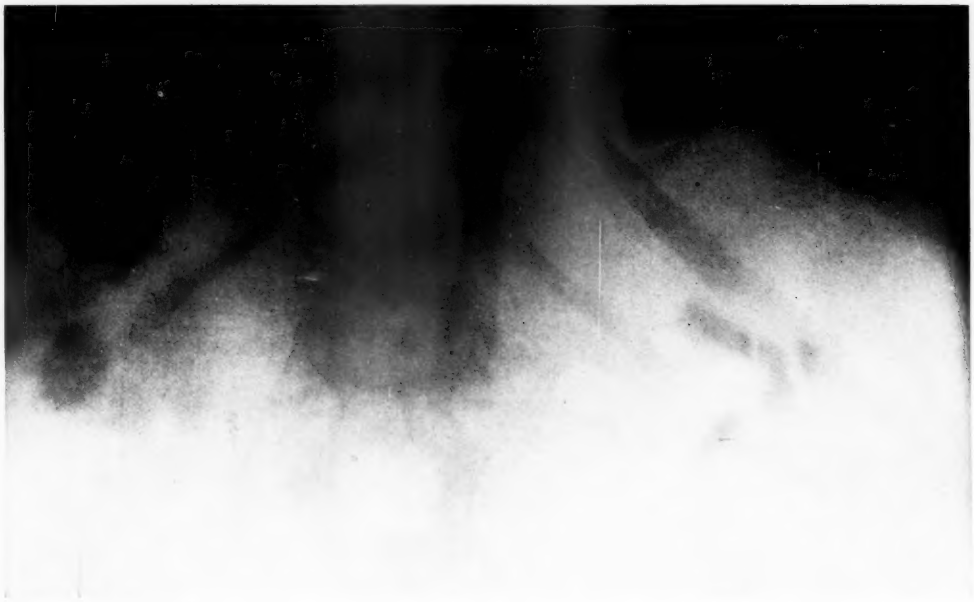


Fig. 13. Bilateral renal calculi. Case of Dr. Anna M. Braunwarth. Note long shadow (left) due to calculus extending into ureter.

is almost impossible, unless the calculus is situated close to the orifice of the ureter. In calculi which the X-ray shows to be located at the outlet of the pelvis, the operation of pyelotomy is to be preferred, provided that the other conditions spoken of above do not offer any contraindications.

There is but little danger of fistula following a pyelotomy, provided the urine is aseptic. If it is not possible to remove the calculus by a pyelotomy alone, the incision can be prolonged, according to Zondek, along the dorsal wall of the pelvis into the parenchyma. If the X-ray shows a calculus in the lower pole of the kidney, one can try (by aid of palpation of the exposed kidney) to remove it by pyelotomy, if it lies in the inferior primary division of the pelvis. If the calculus lies in the upper major calyx, nephrotomy is indicated. Pyelotomy cannot be done, as Israel has called attention to, unless the kidney can be fully brought out to the surface of the skin.

Nephrotomy is indicated if a branched calculus is present, or if multiple calculi are scattered throughout the kidney or in the parenchyma. There is only one danger in nephrotomy, and that is hæmorrhage, but this can be reduced to a minimum if compression of the vessels at the pedicle is made during the incision into the kidney. This compression can be either with the fingers or with some clamp. The clamp cannot be applied unless the kidney pedicle is fairly long and the kidney can be brought well into the wound. Digital compression performed by an assistant is, as a rule, tedious. Some operators use a rubber constrictor around the renal vessels. But this has no particular advantage over the clamp, whose blades are covered with rubber tubing.

The questions which arise in cases of bilateral calculi are whether one should operate in two sittings or remove the calculi from both kidneys at one sitting. The majority of surgeons are of the opinion that it is best to employ the former method, the indications for nephrectomy being the same as those to be outlined below.

There is only one danger in operating these cases in two sittings, and that is, calculus anuria may result from blocking up of the opposite kidney after removal of calculi from the one side. This condition, however can be readily remedied by removing the calculus from the obstructed ureter.

Indications for nephrectomy. The method used to expose the kidney and to perform the various operations for the removal of calculi, whether nephrotomy, pyelotomy, or nephrectomy, is so generally accepted that it is unnecessary to describe the technique here, further than to say that in a case of nephrectomy one must have accurate knowledge of the condition of the opposite kidney, and the kidney operated upon must be in such a condition that it no longer has any functional capacity, and that its retention is a menace to the patient's life, and will probably require a secondary operation. As to how large a calculus must be in order to afford an indication for nephrectomy, this is a matter of individual experience. Many large calculi have been removed through a nephrotomy incision, with uneventful recoveries. The indication for nephrectomy depends rather upon the amount of kidney tissue which will be left after the removal of the calculus. Extensive destruction of the kidney as the result of suppuration is one of the chief indications for a nephrectomy in calculus cases.

THE FATTY FASCIAL FLAP IN PLASTIC AND OTHER OPERATIONS ON THE PELVIS OF THE KIDNEY

By WILLIAM J. MAYO, M.D.
Surgeon to St. Mary's Hospital, Rochester, Minnesota

THE fine grained fat lying in the fascia which is closely attached to the kidney, especially about the sinus and pelvis (inner layer of fatty capsule), is very valuable as a covering after operations upon the pelvis of the kidney, and as a means of protecting the suture-line in the pelvis of a kidney which has been opened for the purpose of removing stones. The plan of utilizing a fatty fascial flap has been employed for the last three years or more in St. Mary's Hospital, and in the considerable number of cases operated upon there has been no leakage of urine, even when the suture coaptation was imperfect.[1]

Of forty operations for the relief of intermittent hydronephrosis (up to December 31, 1909), in sixteen, plastic enlargement of the orifice of the ureter at the juncture of the pelvis was done usually after the plan of Fenger,[2] i. e., a Hœinke Mikulicz pyloroplasty adapted to this situation. In all the cases in which the suture line was protected in this manner, no leakage occurred. Figs. 1, 2, 3, 4.

[1] Mayo-Braasch-MacCarty. Jour. A. M. A., May 1, 1909, pp. 1383–1388.

[2] Fenger. Jour. A. M. A., March 10, 1894, pp. 334–343.

In some of the plastic operations just referred to, after the sutures were in place, it could be seen that at some points the pelvis was not urine tight, yet when covered with the fatty fascial flap, primary union took place. In three instances the nearly or quite detached ureter, after splitting the end on one side to secure a large opening, was sutured to the dilated pelvis by the two-row catgut suture method, like a gastrojejunostomy. The anastomosed area was then surrounded by a fatty fascial flap much as the omentum is used in the peritoneal cavity to protect a doubtful suture line. The result was immediate union and permanent recovery.

St. Mary's Hospital records show one hundred and twenty-two operations for the removal of kidney stones, up to December 31, 1909. Sixty-nine of this number were performed during the years 1907–8–9, and in all in which the stone was confined to the pelvis of the kidney, pelviotomy was done and the suture line covered with the fatty fascial flap. Rapid convalescence without urinary leakage was in marked contrast to our earlier experience in

Fig. 1. Hydronephrosis from kinking ureter, caused by anomalous blood-vessels.

Fig. 2. Blood-vessels cut and tied. Fatty fascial flap raised and ureteropelvic juncture divided.

which provision for leakage was usually necessary. The certainty of union without the necessity of kidney drainage, or the danger of secondary hæmorrhage, etc., has enabled us to substitute pelviotomy for nephrolithotomy as a method of operation for stone in the pelvis, in nearly all cases.

When operating for stones in the pelvis of the kidney it will often be found that there is considerable increase in the fatty tissue attached to and covering the pelvis. If so the attached fat is not removed, but the incision made directly through it as a part of the wall of the pelvis and sutured as a part of the same with No. 1 catgut. Even should the coaptation of the pelvis incision be imperfect, in our experience the fatty covering has efficiently protected against leakage. If the opening in the pelvis is large and irregular from tearing during the removal of a close fitting rough stone, a flap of the fatty fascia can be made from the vicinity and turned across to more perfectly protect the closure. In one instance the pelvis was detached in three-fourths of its extent from the kidney sinus during the removal of a great number of stones from the pelvis and ureter. The patient was obese — the kidney deeply placed and it appeared as though nephrectomy would be necessary; but the pelvis was sutured back to its position with catgut sutures taking in the kidney substance, and the suture-line covered with the fatty fascial flaps. Primary union followed.

In using the fatty fascial flap it is not necessary to suture it closely but merely to place it over the point to be protected and hold in place with two or three catgut sutures applied in such a manner as to keep the parts in apposition.

For operations upon a kidney which is not the seat of a new growth (unless of large dimensions) we use the posterior oblique incision. The patient is placed prone with moderate elevation of the loins, exposing both lumbar regions so that the second kidney can be quickly exposed from behind, if necessary to obtain exact knowledge as to its condition before undertaking a serious operation on the organ primarily affected. The incision is made about four inches in extent, starting two or three inches from the spine above the twelfth rib, extending downward to the iliac crest in a line with the outer border of the quadratus lumborus muscle. If necessary the incision

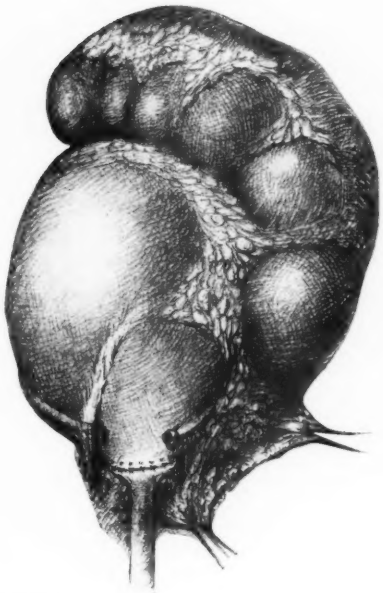


Fig. 3. Plastic operation on ureteropelvic juncture completed.

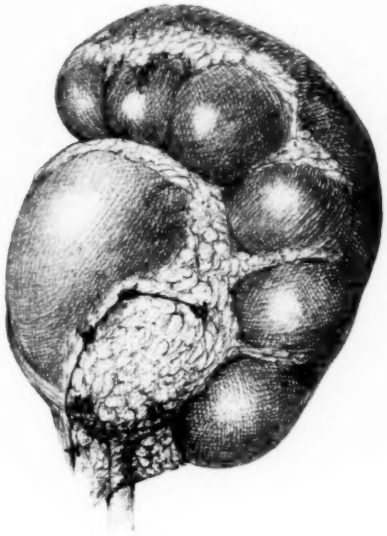


Fig. 4. Fatty fascial flap in position, and held by a few catgut sutures.

is enlarged and the twelfth rib is exposed and divided behind the angle. In doing this the pleura is sometimes opened, and if this occurs it should be sutured with catgut to the posterior muscles by deep sutures. We have opened the pleura a number of times in such cases, but with the patient lying on the face during operation, have never seen collapse of the lung or any harm follow.

Kelly[1] justly calls attention to the superior lumbar triangle as a most important landmark in surgery of the kidney. Incision through this space gives ready exposure to the organ.

Care should be taken not to divide the ileo-inguinal and the ileohypogastric nerves which run in the line of incision. The kidney is drawn up into the wound and the pelvis and upper ureter exposed in the kidney notch, usually from behind. In some cases, as shown by Brödel,[2] the blood-vessels pass to the kidney from behind, and, therefore, the notch is more marked in front. The fatty capsule is stripped from the kidney to the extent necessary to free the organ, and a fatty fascial flap raised either before or after making the working incision in the pelvis. After the operation is completed the fatty fascial flap is placed in position and held by a few catgut sutures; the kidney is replaced and drainage secured by folded strips of rubber tissue, not with gauze, as that might lead to secondary fistula.

[1] Kelly. Jour. A. M. A., January 15, 1910, p. 233.

[2] Brödel. Johns Hopkins Bulletin, January, 1901.

CHORIOMA

A Clinical and Pathological Study

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WHEN, in 1895, Marchand demonstrated that the decidual sarcoma, or "deciduoma malignum," of Sänger is derived from chorionic epithelium and named this tumor "chorioepithelioma," it was felt that not only had important progress been made in the theoretical knowledge of this disease, but that the difficulties surrounding the diagnosis and prognosis of these growths would shortly be removed. This latter hope, however, was destined to fail. As reports of cases multiplied it became more and more apparent that tumors of chorionic epithelium exhibit a remarkably wide variation in histological structure, that the relation between histological structure and prognosis is extremely uncertain, and that many curious features of the natural history of these growths, especially the spontaneous recovery of apparently hopeless cases, are wholly unparalleled by other malignant neoplasms.

To-day it may justly be said that the study of chorioepithelioma presents more peculiar problems and its diagnosis, prognosis, and treatment encounter more special difficulties than exist with any other known tumor process. Especially the introduction of the term "benign chorioepithelioma," together with the claim that the histological structure gives no indication of the probable course of the disease, as once admitted by Marchand, maintained by Schlagenhaufer, and urged by many later writers, has greatly added to the perplexities which meet the clinician and pathologist who have to deal with these cases.

To illustrate the uncertainties of prognosis reference may be made to Schlagenhaufer's report, in 1899, of cases of recovery from chorioepithelioma of apparently identical histological structure showing typical syncytium and Langhans' cells, after (1) spontaneous discharge of the tumor mass from the uterus, (2) removal of the tumor by the curette, or (3) by spontaneous regression after partial removal. At the same time the literature offered numerous examples of a malignant and fatal course of tumors said to have had just such histological structure with or without extensive operations. Apparently histological examination could accomplish little more in the field of chorioepithelioma than to determine the general nature of the process, while offering no reliable evidence on which to base a prognosis or direct treatment.

Marchand had divided the chorionic tumors into two classes, typical and atypical, between which were certain transitional forms.

(1) Typical chorioepithelioma is composed of varying proportions of large multinucleated, eosinophile, syncytial masses, and a smaller proportion of mononuclear, polyhedral, lightly staining Langhans' cells. No great importance was attached to the presence or absence of villi or to the varying degrees of metaplasia of these cells. (2) Atypical chorioepithelioma consists of an infiltration of the uterine muscle with large, acidophile, mononuclear cells which Marchand and others have shown to be derived from the fœtal ectodermal cells. The function of these cells, their resemblance to the syncytium, as well as their association with more definite syncytial masses in the infiltrated muscle, led to their designation as syncytial wandering cells. (3) In the transitional cases there is an increasing proportion of syncytium and wandering cells and decrease or absence of Langhans' cells, as compared with the typical tumors. This classification has been adopted generally.

Although Marchand did not at first find any great difference in prognosis between the two main forms, it has since been recognized that the typical cases are usually malignant, while the atypical form is frequently benign. The presence of villi in the tumors has also frequently been mentioned as affording a relatively favorable prognosis, but I cannot

find that the majority of writers emphasize the prognostic importance of this feature.

Accordingly, the student of chorionic tumors or the practitioner who encounters one of these cases, unless he can acquire a somewhat intimate familiarity with the extensive literature, finds that under the single term "chorioepithelioma" are, on the one hand, benign processes for which Menge declared it to be a crime to remove the uterus, because it is unnecessary, and, on the other hand, cases for which Schmauch virtually admits that it is a crime to remove the uterus because it only hastens the fatal issue. When the inquirer turns to the natural source of help, histological structure, he will find some difficulty in recognizing the atypical variety and remain in doubt what to do with it, or, in the presence of any of the signs of the typical tumor, he will at once remove the uterus on account of the vague and uncertain state of opinion regarding the prognosis in this group of cases. Too often the diagnosis of chorioepithelioma of any variety throws the practitioner into panic and results in immediate hysterectomy, while it is evident that both in this country and abroad the uterus has been removed because it held the remnants of a harmless mole.

Not all observers have been content to leave the question of prognosis in this uncertain state. v. Velits and Meyer, among others, have attempted to distinguish by means of minute histological features between the benign and the malignant tumors, but their conclusions have not received the attention they probably deserve. Moreover, it still remains difficult to determine from the literature what one may believe regarding some of the remarkable clinical features of the disease, such as the alleged recovery after the occurrence of pulmonary metastases, or after partial removal of malignant growths, the possible relation of malignancy to abortion, hydatid mole, and full term normal gestation, the importance of the so-called natural resistance of the patient, and the influence of ovarian secretion in the etiology of chorionic tumors.

From observations on several cases of chorionic tumors, some of which are here reported, and from a somewhat laborious study of the literature, I have been led to believe that more importance can be attached to the histological diagnosis of these tumors than is often claimed, and that certain general relations between histological structure and clinical course can be established which it is of practical importance to point out. It seems highly desirable that the different types of a tumor process which varies so much in structure and clinical course should be designated by more specific terms than are at present in use, and it is proposed to suggest such specific terms. Finally it seems worth while, at the risk of adding unnecessarily to the many miscellaneous discussions of this type, to briefly consider the evidence bearing on some of the remarkable clinical features of chorionic neoplasms.

The observations and comprehensive reviews of the literature published by Teacher, Risel, Munzer, and Schmauch, greatly facilitate the study of this subject and render unnecessary any complete bibliography at this time. The American cases up to 1906 have been reviewed by Frank.

STRUCTURE OF EARLY FŒTAL VILLI

As chorionic tumors arise from the fœtal villi the interpretation of the tumor structure requires a comparison with the normal tissues giving rise to the neoplasm. The early fœtal villi have been studied by Marchand from this point of view.

At the implantation site of the two weeks' ovum he described the irregularly folded ovum as surrounded by villi which reach a length of one millimeter. The villi are composed of a core of mucoid embryonal connective tissue containing a few delicate blood-vessels supported by spindle- and star-shaped cells, and surrounded by two layers of lining cells. The cells of the inner layer, Langhans' cells, are polyhedral, clear staining, with large vesicular nuclei showing remains of occasional mitotic figures. These cells in some places fail to form a continuous layer. The outer layer is composed of flat, syncytial masses, acidophile, continuous, and exhibiting a finely ciliated border. The two layers of cells are sharply demarcated but occasionally transitional forms appear, and this fact together with the close apposition of the two layers led to the conclusion that both layers have a common fœtal

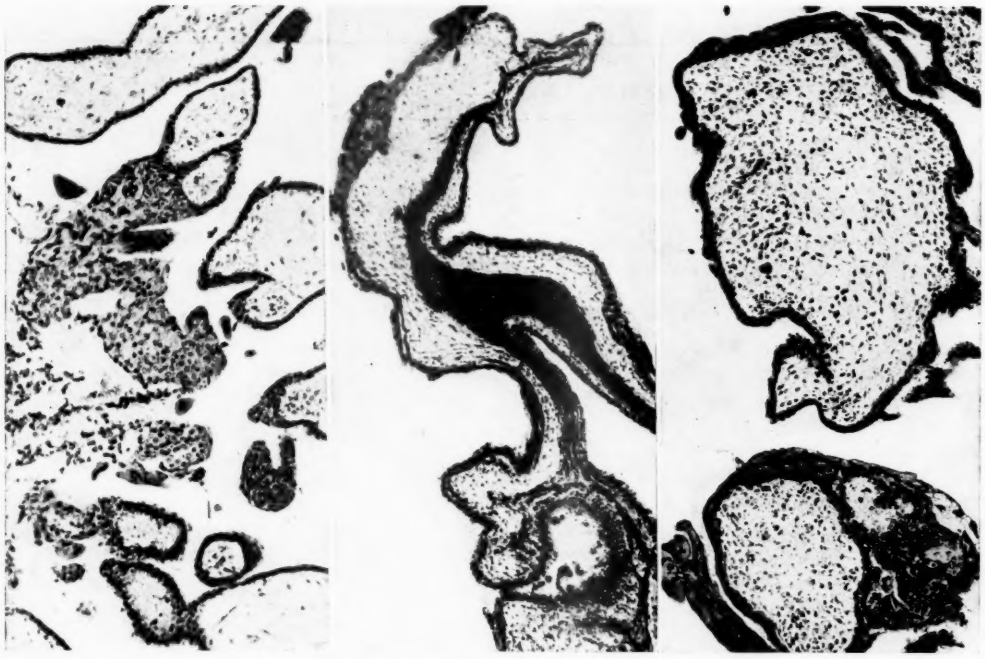

Fig. 1. Normal chorionic epithelium. Ten day fœtus.

Fig. 2. Regressing hydatid mole. Case 1.

Fig. 3. Stationary hydatid mole. Case 2.

ectodermal origin. On this point Marchand is in accord with Peters but at variance with Langhans, yet all these authors express themselves cautiously regarding the evidence on which their views are based. At the tips of the villi the syncytium is often drawn into projecting buds, and some loose syncytial masses are found in sections, while at the bases of the villi there are occasionally seen thicker masses of cells chiefly of Langhans' type.

Where the villi penetrate the decidua the syncytial cells are increased in number, assume a spindle or polyhedral type, and form a layer which irregularly invades the maternal tissue. Some definite syncytial masses may also be found in this situation in the musculature. These ectodermal wandering cells surround the walls of uterine sinuses and become mingled with decidual cells. Many villi, however, are separated from the decidua by a layer of fibrinoid material, Nitabuch's membrane.

These features of the early chorion are the chief and sufficient basis of the view that the atypical chorioma is a tumor of fœtal ectoderm, since the cells of that tumor exactly resemble in morphology and behavior the early fœtal ectodermal cells. For the better appreciation of these few facts regarding the early chorionic structure, which are all that are necessary for the present purpose, Marchand's excellent sketch may be studied. A photograph of the villi of an ovum, 2.2 mm. in length, showing eight dorsal segments, and estimated to be of ten days' development, is also offered. (Fig. 1.)

THE HYDATID MOLE

This well known pathological condition has an important relation to chorioma, since a large proportion of chorionic tumors develop after hydatid mole. The structure of hydatid moles varies greatly and the chief practical question concerns the grade of proliferation exhibited by Langhans' cells and the syncytium. In some cases these cells fail to exhibit any increased growth and such moles generally

pursue a favorable course. In other cases the proliferation of cells is considerable and such processes either suggest malignancy, or the proliferation reaches a neoplastic grade, displays definite characters of an invasive tumor and falls in the class of chorioma. One encounters all gradations between the above extremes and some experience is necessary before one can decide just what histological appearances are harmless and what must be regarded with suspicion. To illustrate this field the following cases are recorded.

CASE 1. *Hydatid mole. Regressing. Suppurating corpus luteum cyst.*

Mrs. X., Austrian, 30 years, multipara. Last child, February, 1900. No miscarriages. Admitted to Lying-in Hospital, February 1, 1902, service of Dr. W. S. Stone, to whom I am indebted for the clinical history and material. On admission patient was suffering from marked pallor and albuminuria, while the abdomen was of the size of full term gestation. Diagnosis, dead fœtus. The uterus was emptied of a large hydatid mole about three liters in bulk. February 10th the uterus was again curetted on account of recurring hæmorrhage. A small tumor was then noted above and to left of uterus. April 10th the patient re-entered the hospital for recurring hæmorrhage, weakness, and loss of flesh. The tumor was larger, and tender. The uterus was enlarged, cervix badly eroded and bathed in muco-pus tinged with blood. Laparotomy revealed a large cystic tumor of the left ovary attached to omentum, intestines, and uterus. It consisted of thickened omentum and a suppurating corpus luteum cyst. For surgical reasons the uterus was removed with the tumor. Three months later the patient reported well.

The mole contained a large number of dilated translucent vesicles of large size, many systems of small opaque vesicles, and considerable fibrin coating many vesicles and forming large coherent masses. No trace of the fœtus could be found.

Microscopically many of the villi are distended with fluid, some show loose calcific deposits, and some exhibit a cellular stroma. Blood-vessels were not recognizable. The chief cells in evidence are scanty, low syncytial buds with well staining nuclei. The syncytium forms a continuous flat layer along the villi. Langhans' cells are not clearly defined, but at the bases of the villi syncytium is missing, and the lining is composed of two or three layers of polyhedral cells with clear protoplasm. The syncytium is often broken up into large or giant mononuclear cells resembling syncytial wandering cells. At many points the cell lining of the whole villus is necrotic and covered with fibrin. Over some villi the cell lining has the appearance of stratified squamous epithelium. The whole appearance is that of very feeble cell life, with regression, degeneration, and necrosis prominent. (See Fig. 2.)

The uterus contained no trace of the mole. The tumor was a multilocular cyst lined by suppurating granulation tissue containing many large degenerating lutein cells and immense numbers of plasma cells.

CASE 2. *Hydatid mole of early chorion. Very slight proliferation of syncytium. Favorable course.*

Mrs. M. M., 19 years, married two months. Last menstruation, February 22, 1909. On March 30th there was pain in pelvis with severe hæmorrhage from vagina lasting six hours. April 6th hæmorrhage recurred. April 25th a third hæmorrhage. April 26th patient was admitted to Bellevue Hospital, service of Dr. Barrows, to whom I am indebted for the history and material. She was then well nourished, but anæmic, restless, and anxious. Pulse 112, temperature 100° F. The fundus uteri reached two inches above umbilicus. Os firm, contracted, discharging bright blood. Red cells, 2,620,000; leucocytes, 31,000; polynuclears, 85 per cent. Operation by Dr. Barrows. A small mass of tissue two inches in diameter, resembling placenta, was found in the vagina. A small attached cord led into a blood clot, no fœtus being found. The uterus was cleared by the curette of two liters of hydatid mole, and irrigated with hot saline. A profuse bloody discharge continued for two weeks, becoming purulent and then gradually subsiding. On May 15th the temperature was normal. May 15th, discharged cured, the uterus being completely involuted, not tender, free from discharge. There has been no recurrence.

The specimen exhibited the usual features of hydatid mole, but with great preponderance of uniformly small translucent vesicles. Microscopically the stroma of the villi was rather cellular and often without marked hydrops. The syncytium showed a moderate number of low buds and Langhans' cells were scanty. (See Fig. 3.)

CASE 3. *Hydatid mole. Considerable proliferation of syncytium. Favorable course.*

Mrs. M. F., 21 years, primipara, no miscarriages. Menstruated last on June 1, 1905. September 15th there was sharp pelvic pain and two ounces of blood were discharged from uterus. These attacks were repeated at intervals, and a slight bloody discharge was noted nearly every day. In October small grape-like bodies were several times noted in the discharge. On November 17th the pain and hæmorrhage were severe and protracted, and larger masses of grape-like bodies were discharged. When packing the vagina failed to stop the bleeding, on November 19th the patient was sent to the Manhattan Maternity Hospital, service of Dr. Edgar, to whom I am indebted for the history and material.

On admission the general condition was good. Uterus reached to umbilicus. Moderate bloody discharge from patulous os. No fœtal heart sounds. Pulse 120, temperature 100° F. Labor pains began at 8 P. M. A large hydatid mole without trace of fœtus was delivered spontaneously at 11 P. M. The uterus was further cleared by the hand, and then by a sharp curette, and irrigated with saline, by Dr. B. H. Gray. Bichloride douches were continued for ten days. The

Fig. 4. Hydatid mole. Localized proliferation. Case 3

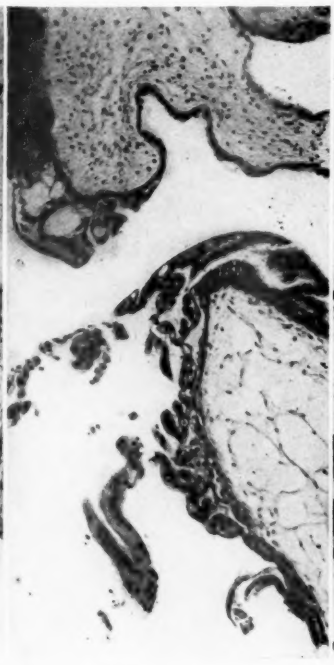

Fig. 5. Hydatid mole. Syncytial proliferation. Case 3.

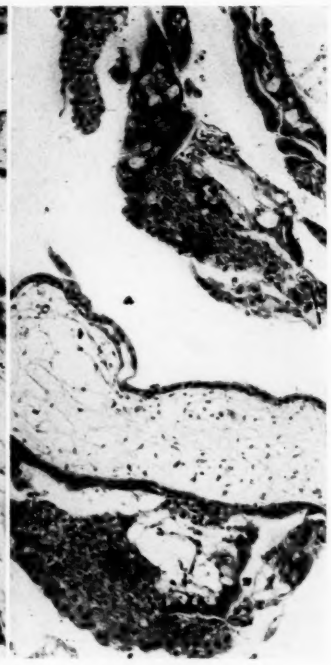

Fig. 6. Hydatid mole. General proliferation. Case 4.

lochia steadily diminished, the uterus involuted normally, there was slight fever, 100° F., for five days, but on December 4th the patient was discharged cured, the pelvic organs revealing no abnormality. For eight months thereafter she was at the Vanderbilt Clinic under the care of Dr. Ellice McDonald, who informs me that the ovaries were not enlarged, the pelvic organs were normal, and there were no signs of any tumor process.

The mole was of considerable dimensions, and contained many large vesicles and more numerous small opaque globules covered with fibrin and blood clot. Microscopically the epithelium covering the villi showed distinct hyperplasia, especially of the syncytium, which in many foci formed a high vacuolated net work or long tongue-like projections. The greater part of the lining, however, consisted of one or two layers of low cuboidal cells. Langhans' cells were found in some compact groups but were hardly more numerous than in many early normal placentas, and they failed to show mitoses. On account of the proliferating syncytium, a guarded prognosis was given. Nevertheless the patient made a rapid and complete recovery. Possibly the curettage was an essential step in this recovery. (See Figs. 4 and 5.)

CASE 4. *Hydatid mole. Distinct proliferation of syncytium. Favorable course.*

Mrs. T. V., 35 years, Greek, 9-para. Last menstruation, February, 1903. April 10th, patient noticed enlargement of abdomen and some loss of flesh. May 10th there were hæmorrhage from uterus, pelvic pain, and prostration. The hæmorrhages were repeated daily. About May 30th the abdomen enlarged rapidly. June 7, 1903, admitted to Bellevue Hospital, service of Dr. W. M. Polk, to whom I am indebted for the history and material. Patient was found poorly nourished, weak, and anæmic. Temperature 99.8° F., pulse 90. Uterus enlarged as in pregnancy. Os patulous, mucoid discharge. June 8th there was severe hæmorrhage with pain and vomiting. Fundus now rose to a level midway between umbilicus and ensiform. June 9th, uterus at ensiform, firm, tender. Severe abdominal pain. Temperature 103°. Under ether uterus was emptied of a large hydatid mole without trace of fœtus, but with a portion of apparently normal placenta. Considerable discharge continued until June 5th, but yielded to daily saline douches. June 16th, red cells, 2,240,000, leucocytes, 35,000. Temperature 99°. For a few days there were headache and pains in the legs. On July 2d the uterus was well involuted, free from discharge, and the patient was allowed to go home. A year later she was alive and well.

The material received consisted of a large hydatid mole filling a two-liter jar. It contained a moderate number of large translucent vesicles and an unusually large proportion of small opaque globules in branching systems. No fœtus or normal placental tissue were

found. Microscopically the structure was very similar to that of case 3, but about some villi the proliferation of syncytium was rather more advanced. Langhans' cells were scanty and no islands of mitotic cells were found. The complete involution of the uterus, the rapid general improvement, and the freedom from recurrence support the conclusion drawn from the histological study that the process was entirely benign. (See Fig. 6.)

Summary of observations on hydatid mole. The foregoing cases illustrate the scope of structural variations of the benign hydatid mole. In a series of fourteen hydatid moles which I have examined for this purpose the structure fell between the limits described in cases 1 and 4. In the cases showing the greatest proliferation, 3 and 4, there were some foci in which the syncytium was more abundant and vigorous and the areas of Langhans' cells more extensive than is seen in normal placentas, but this excessive cellular activity was not marked by any progressive changes in the morphology of the cells. It is significant also that in these cases the proliferating cells were limited to small foci while most of the cell layer was normal or regressing. On comparing these suspicious moles with the chorionic structures in abortions one finds that moderate excess of syncytium and Langhans' cells is not uncommon in the absence of hydatid changes in cases which are not followed by any tumor of the uterus. Comparing these same changes with the earliest genuine neoplasm of the chorionic epithelium, as illustrated in case 5, one finds a wide gap between the most suspicious of the moles and the genuine tumor. The conclusion may therefore be drawn that the proliferation of cells in these moles is not neoplastic. The fact that the curette was capable of removing the entire chorionic mass shows that it had not invaded the sinuses as does the so-called malignant placental polyp.

On account of the abundance of syncytial buds and Langhans' cells present in cases 3 and 4, and of the complete cure by curettage, the suspicion arises that some cases of chorioma reported as recovering spontaneously, or after curettage, were only relatively harmless moles. Yet many hydatid moles are followed by chorioma. While the structure of such moles has not been fully determined, it seems reasonable to assume that a mole which penetrates the sinuses sufficiently to escape the curette must show more extensive cell growth than was exhibited by the cases here reported. The frequency of chorioma following hydatid moles renders it advisable to treat all cases by thorough curettage. The occurrence of partial molar degeneration, the possible variation in structure of different portions of the same mole, and the influence of the period of gestation at which the mole arises upon its structure, are topics on which the present cases offer no definite data.

In only two cases was the condition of the ovaries determined. In one there was a suppurating corpus luteum cyst, while in another no enlargement of the ovaries was detected shortly after the expulsion of the mole.

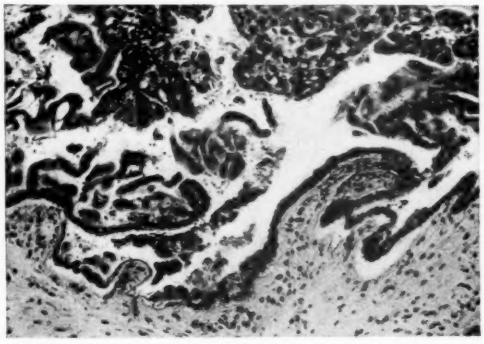

Fig. 7. Chorioadenoma. Case 5.

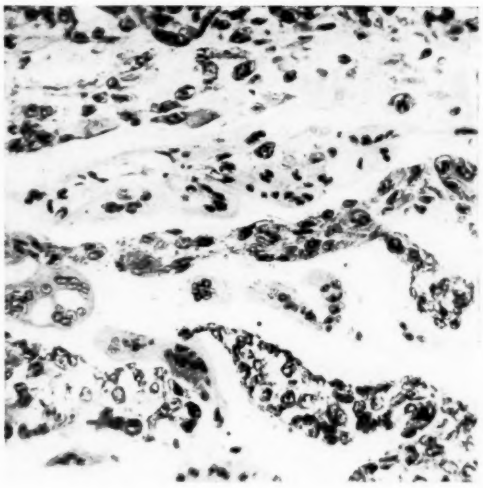

Fig. 8. Chorioadenoma. Case 5.

CHORIOADENOMA DESTRUENS. MALIGNANT PLACENTAL POLYP. TYPICAL CHORIO-EPITHELIOMA, MARCHAND

When the mildest type of a genuine neoplastic process becomes established in the chorionic epithelium the resulting structure is extremely characteristic. The tumor is composed of elongated hypertrophic villi clothed with actively proliferating cells of both types. Such villi infiltrate the uterine sinuses usually over a wide area, enlarging the organ uniformly and often projecting as a polypoid tumor into the uterine cavity. The term destructive placental

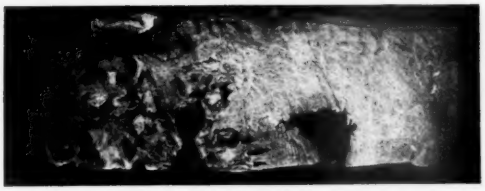

Fig. 9. Chorioadenoma. Distension of uterine sinuses. Case 5.

polyp is well adapted to these gross characters although the growth is seldom polypoid. According to the reported cases this tumor tends to remain long confined to the uterine cavity or wall, but in many instances extensions have occurred to the broad ligaments and pelvic veins, and metastases in the vagina containing villi, or in the lungs, where whole villi were once found by Solowij and Krzyskowski. It rarely, if ever, produces general metastases. It is this tumor which has been found subject to such great variation in clinical course, to be discussed later. The tumor reproduces in rather orderly fashion all the structures of a normal villus. Apparently the cells possess a limited capacity for growth apart from the core of the villus.

Whole villi, however, are not always retained, or if present are not always encountered in

Fig. 10. Choriocarcinoma. Uterus. Cystic ovaries. Case 6.

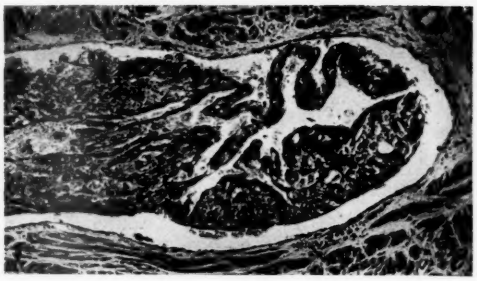

Fig. 11. Choriocarcinoma in uterine sinus. Case 6.

tumors of this type. They may be found in one portion of the tumor but not in another, or in the main tumor but not in the metastases. While the presence of the villi is a very definite and reliable ground for classification, more constant and important criteria are the presence of rather orderly branching buds of vacuolated syncytium and sharply defined Langhans' cells which show no pronounced metaplasia or morphological variation from the normal type. (Figs. 7 and 8.)

These histological characters, and the fact that they are associated as a rule with distinguishing clinical features which are of much practical importance, lead the writer to suggest for this type of chorioma the term *chorioadenoma destruens.*

In 1886 H. Klotz employed the term "adenoma of the placenta" to designate the structures found in three cases of destructive placental polyp. Although Klotz failed to distinguish between the normal hypertrophic uterine glands and fœtal ectodermal elements of the tumor, some of the structures which impressed him as adenomatous were buds of syncytium and Langhans' cells and possibly fœtal villi. Munzer, in commenting upon Klotz' suggestion, exclaims, "Since when has the placenta had glands!" Yet the placental villi are glands in every essential respect, both anatomical and physiological, and a tumor which reproduces in an orderly manner the structures of a glandular organ is by current definition an adenoma.

The grounds for separating the destructive placental polyp from other forms of the typical chorioma are chiefly practical ones. It makes

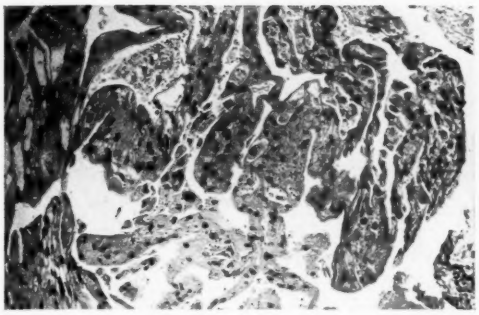

Fig. 12. Choriocarcinoma. Case 6.

much difference to the clinician and to the patient whether the laboratory diagnosis carries with it a necessarily hopeless prognosis or a chance for recovery, and it is just because the average destructive polyp offers a hopeful prognosis which some other typical choriomata do not, that specific terms are desirable.

The following case illustrates the distinguishing features of chorioadenoma destruens or destructive placental polyp.

Case 5. Mrs. K., age 48, always well, had eight living children, two abortions. Five months before coming under observation had an abortion at the third month, which was followed by such profuse hæmorrhage that she was curetted. Curettings not examined. The bleeding continued. At this time the uterus was found to be uniformly enlarged to the size of a four months' gestation, and was bleeding continuously. A malignant tumor was diagnosed and supravaginal hysterectomy performed, after curettage. The patient did not recover from the operation.

The specimen as received by the writer was a much enlarged uterus, measuring eleven cm. in lateral diameter at the fundus. The cervix was missing and the cavity had been laid open so that it was impossible to determine the other diameters or to restore the organ to its original form. The cavity had been cleared of any polypoid outgrowths by the curette, but was considerably enlarged.

The tumor occupied chiefly the left side of the fundus wall, extending from the mucosa to the peritoneum. This portion of the wall, seven cm. in diameter, is everywhere infiltrated by solid grayish, hæmorrhagic masses and translucent mucoid nodules of tumor tissue distending the uterine vessels. Some of these masses produced nodular elevations of the surface but had not perforated the peritoneum. The right and posterior portions of the uterus are free from tumor but the wall is much thickened (2.5 cm.). The main gross feature of the uterus is therefore an extensive honeycombing of the uterine wall without perforation, and is illustrated in Fig. 9.

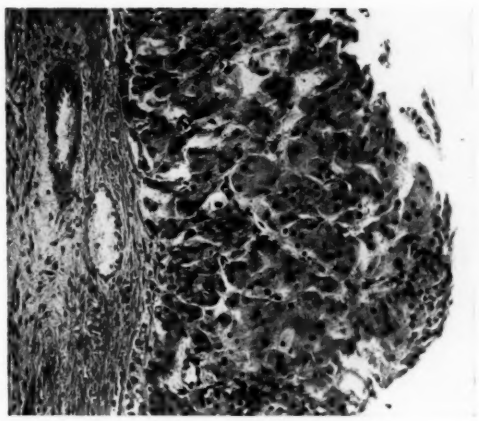

Fig. 13. Hypertrophic lutein cells in ovarian cysts. Case 6.

The ovaries were not removed with the uterus and their exact condition was not determined.

Microscopically the tumor tissue is apparently limited to the uterine sinuses, which are widely distended by large villi with thickened stroma and hypertrophic epithelium. The villi are greatly elongated and the stroma shows an abundance of well preserved cells, or they are widely distended by thin mucoid material. Nearly all the villi are covered uniformly with proliferating syncytium which is often branching and vacuolated but without mitoses.

About many villi are islands of Langhans' cells, which are sharply demarcated from the syncytium, and show occasional mitoses. Both syncytium and Langhans' cells are well nourished and exhibit the histological signs of complete vitality.

The sinuses contain considerable blood and old and fresh fibrin and these masses are often fringed with

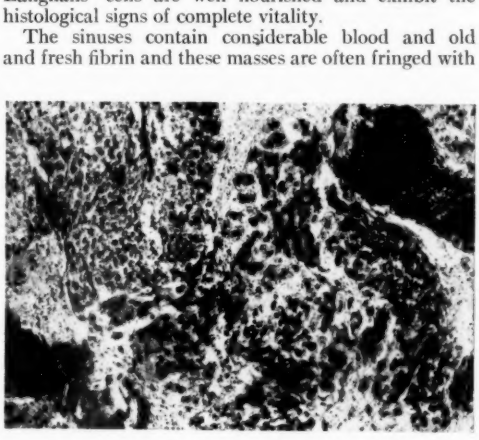

Fig. 14. Choriocarcinoma. Uterine curettings. Case 8.

fragmented syncytial cells. Some of the masses also contain necrotic villi. The muscle tissue shows very little infiltration with syncytial wandering cells.

The main microscopical feature of this case is the neoplastic but orderly proliferation of two well defined types of cells which appear to be somewhat dependent for vitality upon their connection with villi.

Epicritical considerations. The first practical conclusion that may be drawn from this case is that the typical destructive placental polyp is strikingly different in histological structure from the innocent hydatid mole. In the suspicious hydatid mole there are occasional groups of proliferating cells which suggest a capacity for the independent existence of a tumor, but in the destructive placental polyp it is apparent at a glance that one is dealing with a genuine neoplastic process. Here as in other fields the distinction between simple and neoplastic hyperplasia reveals itself in an unmistakable manner. It is possible that a larger experience would yield intermediate cases in which it would be difficult to decide whether one had to deal with a true neoplastic process or a harmless proliferation. Yet such conditions are generally rare. In the mucous membranes, kidney, liver, prostate, thyroid, and breast, a genuine adenoma is usually clearly recognizable as such, and the same rule seems to apply to the chorion. Hence the writer concludes that there is probably a wide gap between a simple hydatid mole and the earliest true neoplasm of the chorionic epithelium.

Second. The question arises what term properly designates the earliest true neoplasm of the chorionic epithelium. The tumor process affects only the epithelium, causing an orderly proliferation with slight metaplasia and preservation of cell types. The stroma of the villi shows no neoplastic qualities and the elongation of the villi appears to be largely mechanical or at least secondary to the epithelial growth. For such a process affecting a glandular organ the term adenoma seems to accord with established usage.

The term chorionic papilloma is also adapted to emphasize the branching buds of syncytium, but seems less appropriate for the various cellular structures of a complex glandular organ such as the chorion. That the chorion is a gland has already been urged.

Third. It may be objected that there is no necessity for emphasizing the existence of this special variety of typical chorioma or of introducing a new term for a growth which has much the same course and histology as other choriomata, for chorioadenoma produces metastases, it may prove fatal, and in curettings it may be difficult to separate from other typical choriomata.

It is true that chorioadenoma produces metastases, but these are apt to be limited in extent, and, as will be shown later, they may undergo spontaneous regression, whereas metastases from other types of chorioma, with a few possible exceptions, have never been known to regress. The fatalities from chorioadenoma are not so much from the progressive invasion by the tumor as from local hæmorrhage, infection, or other accidents.

The *course* of chorioadenoma resembles in many respects that of more malignant choriomata, but differs nevertheless in essential particulars. (*a*) It tends to produce greater enlargement of the uterus, often with polypoid tumors distending the cavity, and only slowly perforates the organ with extensions into the pelvic veins. (*b*) It may be cured by curettage or by partial removal, and perhaps by spontaneous expulsion, results not observed with more malignant tumors. (*c*) Its definite histology is easily recognized in any thorough examination of the mass of curettings that are obtainable by a careful operator from such cases. I conclude, therefore, that there exists a special variety of Marchand's typical chorioepithelioma, often called destructive placental polyp, for which there are adequate theoretical and practical reasons for introducing the term *chorioadenoma destruens.*

The *treatment* of such cases offers unusual difficulties. When the diagnosis of chorioadenoma is established the controlling consideration is the moderate potential malignancy of the tumor. It is not necessary at once to extirpate the uterus. It is necessary first to ascertain the extent of the involvement of this organ. A greatly enlarged uterus with constant or alarming hæmorrhage, or with severe infection, would seem to call for hysterectomy. Even the presence of signs of metastases, or inability to remove all the invaded pelvic

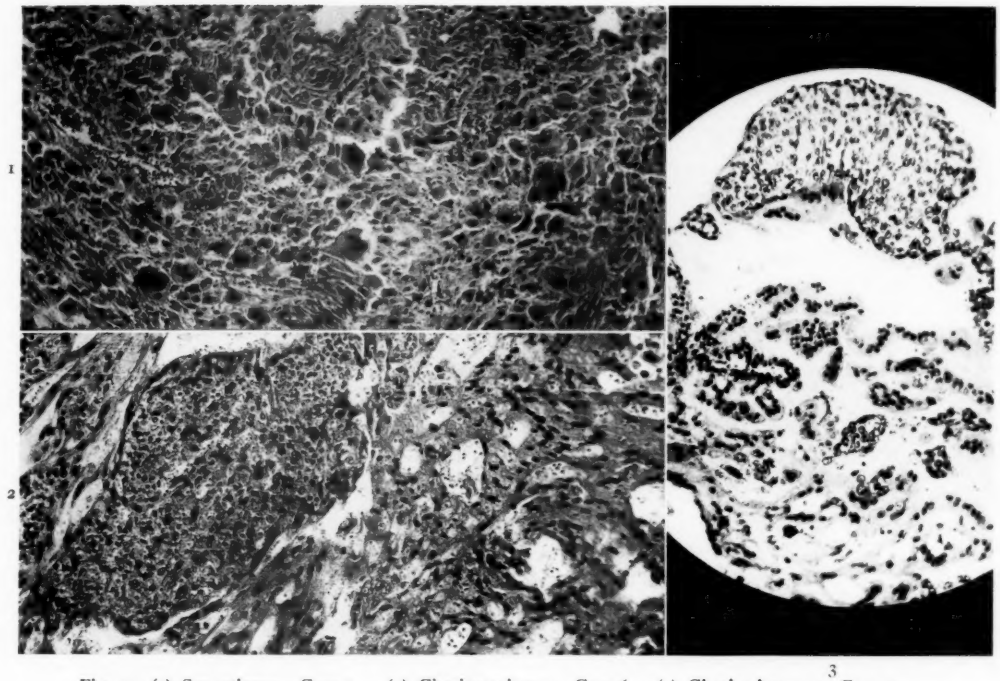

Fig. 15. (1) Syncytioma. Case 9. (2) Choriocarcinoma. Case 6. (3) Chorioadenoma. Case 5.

tissues, should not delay the operation or warrant a necessarily hopeless prognosis.

With tumors less advanced, in young subjects in whom the loss of the uterus is a serious consideration, conservative treatment is clearly indicated. In such cases it would seem that the uterus should be thoroughly explored and curetted and any vaginal metastases removed. If the symptoms recur and curettings still show that the curette has not removed all the tumor tissue, hysterectomy is then the indication. The time required to determine the result of the first curettage is an uncertain feature of this plan, but with chorioadenoma the necessary delay will not greatly influence the prognosis, while it may save the uterus.

CHORIOCARCINOMA. MALIGNANT TYPICAL CHORIOEPITHELIOMA OF MARCHAND

The majority of malignant tumors of the chorion exhibit a structure quite different from that of the process designated as chorioadenoma. Their chief histological features are absence of villi, and very extensive proliferation and *pronounced metaplasia* of Langhans' cells and syncytium. Their anatomical and clinical characters are illustrated by the following cases.

CASE 6.[1] *Choriocarcinoma. Recurrence after curettage and after hysterectomy. Local and general metastases. Bilateral cystic ovaries. Death twenty-one months after first symptoms.*

Clinical history. Mrs. X., 35 years of age, had three healthy children. General neurotic symptoms of several years' duration, attributed to shock, more probably due to atypical Graves' disease.

Last menstruation July, 1905, normal. December, 1905, metrorrhagia appeared, followed in three weeks by delivery of a macerated fœtus. March, 1906, flow returned, and in April she was curetted. Bleeding ceased for a time, but soon returned at short intervals. August, 1906, no symptoms. September 1st, bleeding returned, and uterus was found retroflexed, soft, size of two months' gestation. September 5th, curettage brought away considerable masses of tissue showing typical chorioma.

As bleeding ceased and uterus returned to normal size, and general health improved, it was decided to

[1] A report of this case was published by Dr. J. J. Edgerton, in the New York Polyclinic, 1908, vol. 12, March, p. 31.

Fig. 16. Giant cells in syncytioma. Case 9.

delay hysterectomy, This decision was influenced by current statements in the literature that histological structure is no guide to malignancy.

November 7th, bleeding recurred and as curettage showed same malignant structure, hysterectomy was done. Patient remained well for some months except for old nervous symptoms, but in July, 1907, there were marked uncertainty in gait, much pain in right knee and hip, dyspnœa, and anæmia. These symptoms, especially the dyspnœa, increased and death occurred September 25, 1907.

Autopsy, twelve hours after death, by the writer.

Body considerably emaciated, anæmic. Slight œdema of lower extremities. Few adhesions over left upper lobe. No fluid in either pleural cavity or peritoneum; about one ounce in pericardium. *Lungs:* Both lungs, especially the left, studded with many solid tumor masses one-fourth to three cm. in diameter, firm, centers light colored, peripheries hæmorrhagic. Remaining parenchyma intensely congested, certain lobules emphysematous. Projecting like a finger into the right auricle from one pulmonary vein and occluding it is a mass of whitish tissue which is continuous through the vein with a tumor mass in right upper lobe. *Heart:* Moderately enlarged, left chambers filled with antemortem clot. Valves and chambers normal. Muscle pale but not fatty. Attached to wall of left auricle is a solid whitish mass size of pea, with several smaller nodules in neighborhood. Pericardium normal. Slight atheroma at base of aorta. *Spleen* slightly enlarged, firm, œdematous, dark, follicles invisible. Small supernumerary spleen. No metastases. *Liver:* Size normal, consistence reduced, surface peculiarly mottled, section strikingly nutmeg, but congested areas irregular. Several small tumor nodules in right lobe. *Kidneys:* Size, consistence, normal; capsule uniformly adherent, shows numerous deep red depressed areas in which markings are absent. Cortex irregular in thickness, markings mostly regular. No gross arteritis. *Adrenals* normal. *Pelvis:* Uterus and ovaries missing, scar smooth, fully healed. Pelvic contents fused together by solid tumor growth which is adherent to peritoneum, compressing anterior crural nerve and penetrates right femoral vein to three inches below ring, and surrounding bladder, vagina and rectum. No metastases project into vagina. *Pancreas* appears normal. Abdominal lymph nodes normal. *Thyroid* small and firm. *Thymus* atrophic. Brain not examined. *Volume of blood* slightly reduced, fibrin normal, slightly watery. *Anatomical diagnosis:* Secondary choriomata of pelvis, lungs, liver. Chronic congestion of liver, spleen, kidneys. Moderate anæmia. Hypoplasia of thyroid.

Uterus: Gross appearance. See Fig. 10.

The uterus is slightly enlarged, measuring 10 x 8 x 4½ cm., cavity 9½ cm., slightly dilated. Occupying the right posterior portion of the fundus wall is a solid, circumscribed tumor mass 4½ x 4 x 3 cm., reaching from the mucosa almost to the peritoneum but not perforating the organ. Except over a limited area at the apex of the uterine cavity the tumor is separated from the cavity and protected from the curette by muscular tissue, so that it would have been quite impossible to reach the main mass of the growth by curettage. No secondary deposits were discovered.

Microscopical examination. Figs. 11 and 12. *First curettings:* The tissue is composed about equally of broad masses of syncytium and Langhans' cells. The syncytium is not found in the form of branching buds but as broad sheets of acidophile protoplasm containing huge nuclei. Langhans' cells appear in broad masses of large polyhedral cells with nuclei very rich in chromatin and frequently showing remains of mitotic figures. Villi were absent.

Second curettings: Show same structure. *Uterine tumor:* The new growth forms a compact mass occupying the uterine sinuses and causing atrophy of intervening muscle tissue. Detached masses of tumor tissue are found in several adjacent sinuses, indicating that metastases had occurred before the hysterectomy. The structure of the tumor closely resembles that of the curettings. The syncytium appears in broad masses of compact anastomosing bands which resemble huge stratified, squamous epithelial cells. There is little vacuolation or degeneration, and the syncytial buds of chorioadenoma are entirely wanting. Langhans' cells are of very large size, but with polyhedral borders, clear cytoplasm, vesicular nuclei rich in chromatin, and showing mitotic figures. These cells are often distinct from the syncytium, but in many places merge insensibly into it. In some sinuses the tumor mass is adherent to the wall and syncytial wandering cells have slighdly invaded the muscle. Elsewhere the muscularis is free from syncytial wandering cells. Inflammatory reaction is very slight and there is little necrosis or deposit of fibrin.

The appearance is wholly different from that of chorioadenoma and indicates a neoplastic process of great malignancy.

The *pelvic tumor* masses are composed of areas of Langhans' cells mingled with bands of syncytium. There are many vascular channels walled by bands of Langhans' cells and lined by syncytium. There are many areas of coagulated blood and necrotic tumor tissue.

In the lungs many tumor areas are composed exclusively of Langhans' cells, giving the appearance of an adrenal perithelioma. In some few, however, the syncytium is prominent. The same structures appear in the metastases in the liver. The nodules in the heart muscle are composed of fibrin and pus with necrotic masses in which tumor cells are not recognizable.

Ovaries: Both are much enlarged, 8 x 5 x 4 cm., and contain numerous cysts 1 to 2 cm. in diameter, filled with slightly blood-stained watery fluid. All of these cysts are lined by many layers of hypertrophic lutein cells which give a characteristic yellowish tinge in the gross. Fig. 13

CASE 7. *Choriocarcinoma. General metastases. Early cystic changes in ovaries.*

Clinical history: Mrs. J. M., 27 years. One year after marriage, at fifth month of pregnancy, she had a miscarriage from which there was perfect recovery. One year later, December, 1904, another miscarriage occurred at third month, accompanied by fœtid discharge. At this time she was confined to a hospital in Antwerp for two months. In March, 1905, she came to New York where she enjoyed excellent health. In November she began to complain of a sense of weight in the pelvis. For two months there was some menorrhagia, after which menses stopped for three months. In May, 1906, there was a profuse hæmorrhage, for which curettement was performed. The curettings were said to have contained "little white balls." Thereafter hæmorrhage persisted, there were anæmia, general weakness, failing vision, and later nausea and vomiting. August 7th, there was a general clonic convulsion. On August 15, 1906, she was admitted to Lincoln Hospital, in the service of Dr. L. H. Shearer, to whom I am greatly indebted for very full clinical notes, autopsy records, and the material from the case.

On examination she was now found emaciated, anæmic, with persistent headache and vomiting. The uterus was retroflexed, as large as in three months' gestation. It was somewhat firm, not tender, cervix slightly patulous. There was a slight blood-tinged discharge. Later a small tumor was found behind and to the right of the uterus. August 20th, sudden diplopia of right eye, with dilatation of pupil, followed later in the day by a clonic convulsion. No pulmonary symptoms. Violent headache, vomiting, bloody discharge, delirium, and increasing weakness, ended fatally September 3d, ten and a half months from beginning of symptoms.

Abbreviated report of autopsy, by Dr. Shearer: *Body*: Emaciated and anæmic. *Lungs:* Both lungs are the seat of numerous firm hæmorrhagic nodules .5 to 2 cm. in diameter, projecting on pleural surface and especially on the anterior surface. *Heart:* Negative. *Liver*: Shows chronic congestion and a few small tumor nodules. *Spleen:* Shows one tumor nodule 1 cm. in diameter, well below the surface. *Kidneys:* Few small tumor nodules in each. *Brain:* At tip of left occipital lobe was a hæmorrhagic tumor nodule .75 cm. in diameter. In the left motor area were two small superficial tumor nodules 1 cm. in diameter.

Uterus: The uterus is moderately enlarged by the presence of two rounded swellings, one in the anterior portion of the fundus wall, the other just above the cervix on the posterior aspect. The uterus measures 14 x 8 x6 cm., and the tumors 4 and 6 cm. in diameter. The upper mass is in connection with the mucosa and probably represents the primary tumor. The lower mass is more superficial and is probably of metastatic origin. Both tumors are sharply circumscribed, infiltrated with blood, and their substance readily fragmented. The uterine cavity is not dilated.

Microscopical examination: The ovarian tumors show a structure very similar to that of case 5. The uterine tumors are composed of bands of coarse syncytium traversing areas of very large Langhans' cells. In both cells the nulcei are very rich in chromatin and often of very large size, while the Langhans' cells show occasional mitotic figures. There is little necrosis but some admixture of blood and fibrin. The tumor masses lie in distended sinuses and some of the outlying sinuses contain loose masses of tumor tissue. There is very little infiltration of the muscularis with syncytial wandering cells. Villi are entirely missing.

In the lungs the tumors are composed of central masses of disintegrated blood surrounded by a row of tumor cells which are almost entirely of the Langhans' type. In some small nodules the structure is not to be distinguished from the usual metastases of breast cancer, except by the slight eosin stain of the cell bodies. In the splenic nodules syncytial cells are more numerous. In the brain the scanty cells about the hæmorrhagic areas are large, mononuclear, acidophile, or necrotic. In all the tumors the appearance is that of active cell growth of pronounced malignancy.

CASE 8. *Choriocarcinoma. Pulmonary metastases. Death seven months after first symptoms. No autopsy.*

History: Mrs. E., 42 years, Italian, entered New York Hospital July 14 ,1905. Illness began with miscarriage in January, 1905, which was followed by metrorrhagia, pain in pelvis, cough, weakness, loss of flesh, and anæmia. In March menstruation was excessive, very painful, and accompanied by vomiting and prostration, and in April these symptoms were aggravated. In May constant metrorrhagia began. July 4th there was an attack of sharp pain in left side, with dyspnœa, blood-tinged sputum, and night sweats. On admission patient was pale, emaciated, with rapid, small pulse, and a profuse bloody discharge from the uterus. Over both lungs were signs of effusion, and on July 16th and again on July 21st, 70 and 90 ounces of bloody fluid were aspirated. Fig. 14.

The fundus uteri was found 3 cm. above pubes, displaced to right. From the right fornix a mass as large as an orange was palpated. The uterine cavity measured $3\frac{3}{4}$ inches in depth.

Curettage was followed by profuse hæmorrhage and

little tissue was obtained. The operation was followed by a chill, vomiting, temperature 105° F., and the chills recurred daily. A second curettage failed to relieve the local or general condition and the patient died August 2d. No autopsy.

Microscopical examination of the curettings by Dr. W. J. Elser yielded a very few small groups of tissue cells in large masses of blood and fibrin. Neither typical Langhans' cells, syncytium, nor villi were found. The cell groups resemble those described in case 6, and were composed of large acidophile, multinucleated masses, and large polyhedral cells with large vesicular nuclei very rich in chromatin, and with clear cytoplasm. Necrotic cells and leucocytes were absent.

The chief features of this case are the profuse hæmorrhages, the rapid course, the early pulmonary symptoms, and the scanty curettings. It is probable that the uterus contained very little tumor tissue accessible to the curette.

Epicritical remarks on cases of chorio-carcinoma. Cases 6, 7, and 8 illustrate a common form of typical highly malignant chorioepithelioma. The tumor cells in this group exhibit a remarkable capacity for independent growth apart from villi, they show advanced metaplasia and in the metastases a striking loss of differentiation. They grow diffusely, failing to show the orderly arrangement or polarity of the milder forms of chorionic tumors. Their histological appearance is extremely characteristic and no difficulty is experienced in separating them from the tumors called chorioadenoma. Likewise, the gross characters of these tumors are usually quite different from those of chorioadenoma. In the present cases and in most cases in the literature, the tumors in the uterus are comparatively small, in some instances a primary tumor of the uterus has been missing, the organ is but slightly enlarged, but numerous metastases are found in lungs, spleen, brain, and other organs.

The prognosis also in these cases must always be unfavorable. In the presence of this histological structure one may state positively that one is dealing with a tumor of high potential malignancy. The great majority of these tumors prove fatal in spite of early operations. In fact it is still doubtful if any pure cases of this type have been known to recover, although in a few instances, reported by Marchand, (Everke), Schlagenhaufer, Noble, Findley, Langhans (case 2), etc., to be described later, the structure approached that of choriocarcinoma, and yet the patient recovered.

That recovery may follow after internal metastases have occurred appears to the writer extremely unlikely, and there is no satisfactory evidence in the literature that metastases of tumors of this histological type have ever spontaneously regressed. So far as I can determine from the literature, the regressing metastases have always belonged to tumors approximating in structure chorioadenoma or, from the presence of villi, falling distinctly within that class. It is probable that tumors of intermediate type between the relatively benign chorioadenoma and the highly malignant growths do occur. It need not be claimed that an exact prognosis may be given for every case, yet the great majority of tumors recurring after operation fall distinctly in this class which exhibit striking histological signs of malignancy.

In view of these considerations the writer feels that the value of histological structure in establishing a prognosis in this group of cases has been underestimated, and that here as with most other malignant tumors there is a close relation between histological structure and prognosis.

The treatment of this group of cases should be guided by the fact of the high potential malignancy of the tumor. On finding curettings of the above described structure, one should not delay with a preliminary curettage to see if the tumor persists or the clinical signs of uterine disorder recur. Nor should one be deceived by the good general health of the patient or the absence of uterine enlargement or hæmorrhage. Curettage cannot remove these deeply seated ingrowths and hysterectomy is urgently indicated.

When the process is far advanced and there are signs of local or pulmonary metastases, the question arises whether operation will not hasten the fatal issue. On this point one might be disposed to agree theoretically with Schmauch who holds that it is unjustifiable to remove the uterus in cases of advanced typical chorioepithelioma. Yet the possibility of error in diagnosis from scanty curettings is always present and the responsibility of omitting

operation in any of these cases must be considerable.

Finally, in dealing with a tumor which possesses a characteristic histological structure, exhibits striking gross anatomical features, pursues a rapid malignant course, and demands radical treatment, and differs in all these respects from other chorionic tumors, it would seem that a specific term is a practical necessity. For this purpose the term "choriocarcinoma" is suggested by the histological structure and is consistent with the origin and general pathological characters of the tumor. It is true that Marchand rejected the term carcinoma for any of these tumors, because of the uncertain derivation of the cells of origin and the limitation of metastases through the blood-vessels. Yet the cells of origin are fœtal epithelium, and other metastatic carcinomata may grow extensively through the blood-vessels. While often sparing the lymph nodes,metastases of this tumor have been observed in the lymph nodes by several writers, including Chiari, Menge, Gebhard, and Fiedler. When a tumor of glandular epithelium grows diffusely with loss of differentiation of cell types and general metastases, it is by established usage called a carcinoma. Exactly the same objections apply to the term chorioepithelioma, while in America and elsewhere, the term epithelioma is commonly applied to tumors of stratified squamous epithelium. Choriocarcinoma has an advantage also as a proper correlative of adenoma, indicating that greater malignancy which it is desirable to emphasize.

ATYPICAL CHORIOEPITHELIOMA (MARCHAND)

Infiltration of uterus with syncytial wandering cells. Syncytial endometritis.

Marchand early recognized an atypical form of chorioepithelioma in which actively proliferating Langhans' cells and syncytium were missing, and the growth consisted of an extensive infiltration of the uterine muscle and sinus walls with large numbers of large or giant mononuclear cells derived from the syncytium. Similar cells are seen in small numbers in many typical choriomata associated with typical syncytium and Langhans' cells. In certain cases these syncytial cells may constitute a very prominent feature of the new growth, and such cases are often designated as transitional or syncytial chorioma. There are thus wide variations in the proportion of these cells seen in choriomata, but it is only when they are exclusively present and chiefly within the muscle that they constitute the atypical chorioma of Marchand.

The exact interpretation of the significance of these cells in tumor growths requires a knowledge of their physiological relations.

Marchand first clearly showed their origin from the fœtal epithelium and also the fact that in early gestation the anchoring of the ovum in the uterus is accomplished by the invasion of the muscularis by the syncytial derivatives which invaded the uterine sinuses, causing a solution of muscle cells and facilitating the entrance of villi into the deeper sinuses. Pels-Leusden, Meyer, and others have shown that in normal pregnancy nearly all portions of the uterine musculature may be invaded by some of these cells. The extent of this invasion varies considerably, but it is most marked in the early months and continues to advance until the sixth month, but may be entirely missing in the uterus at term (Meyer).

In addition to this strictly physiological occurrence, syncytial wandering cells seem to represent a form of reduced vitality and metaplasia of the syncytium. Thus in regressing hydatid moles, and in the necrosing or degenerating edges of choriomata and about occluded and degenerating villi of the placenta one finds the syncytium breaking up into cells of this type. Fig. 15.

It has been suggested that an excessive invasion of the musculature by these cells leads to abnormal adherence of the placenta, or to changes in the villi that result in death of the fœtus and hydatid mole. It appears certain that an unusual abundance of syncytial cells often occurs in cases of hydatid mole, that they may cause erosion of vessels and thrombosis, and that the inclusion of excessive numbers of villi in certain areas of the uterine muscle is followed by excessive invasion by syncytial cells.

As the syncytial wandering cells resemble decidual cells, it is often difficult to distinguish between them, and in fact they were once erroneously regarded as identical. The cyto-

plasm of the syncytial cells is more opaque and acidophile and the nucleus larger and richer in chromatin.

There can be no doubt that the syncytial wandering cells are capable of multiplying, for their invasive properties have often been likened to those of a malignant tumor, but that these cells ever develop a progressive malignant tumor in a strict sense is still doubtful. The tumor-like masses in which they are found are often of considerable bulk, but the living cells are associated with large masses of necrotic tissue, blood, pus, and fibrin, all of which infiltrate and greatly enlarge the affected portion of the uterine wall. The structure of atypical chorioma has been described in vaginal metastases, but here the wandering cells may merely represent the regressing derivatives of original syncytium which failed to maintain its full vitality. At any rate large circumscribed, well nourished tumors, composed of syncytial wandering cells with metastases of the same structure have not been observed, so that the general significance of masses of such cells is that of an anomalous regressive process with proliferation rather than of an active progressive neoplasm.

The general features of this class of atypical chorioma are illustrated in the following case, for which I am indebted to Dr. W. J. Elser, Pathologist to New York Hospital.

CASE 9. *Atypical chorioepithelioma. Syncytial endometritis. Streptococcus infection. Acute nephritis. Acute purulent peritonitis.*

History. K. C., 19 years, single, domestic. Entered New York Hospital September 1, 1903.

Had enlarged cervical lymph nodes in childhood and one hemoptysis two years before. For six months had complained of occasional vomiting, and for two weeks, of cough and hemoptysis. There was moderate œdema of feet and legs, and the urine contained albumin and casts. September 20th, abdomen became painful and enlarged and soon metrorrhagia appeared, simulating menstruation. There was much pain in back and buttocks, vomiting, attacks of fever, and pronounced abdominal distension. October 9th four liters of slightly turbid fluid was drawn from peritoneal cavity. Vomiting, anasarca, œdema of labia, anæmia, and fever continued, and patient died October 14, 1903.

Abstract of autopsy, twelve hours post-mortem, by Dr. Elser. *Lungs* extremely congested, some old adhesions. No metastases or consolidation. *Heart* negative. *Liver* congested, moderately fatty. *Spleen* enlarged, soft, deep red. *Kidneys*: Cortex swollen, light colored, with hæmorrhagic points. Capsule adherent, markings obscure.

The *peritoneum* contains 1,500 cc. of slightly purulent fluid, little fibrin, no adhesions. There is a continuous area of suppuration extending from the head of pancreas behind colon down to uterus. Veins of right broad ligament exude pus.

The *uterus* is uniformly enlarged, soft, free from adhesions. Length 12 cm., width 7 cm., thickness 6 cm. The enlargement is due to a tumor growing inward from the fundus, involving the upper two-thirds of the posterior wall and upper third of anterior wall. The uterine wall has a fairly uniform thickness of 1 cm. and is not deeply invaded by the tumor. Necrosis is marked in many parts of the tumor and the exposed surface is irregular and ragged. From the right border of the uterus a tumor 2.5 cm. in diameter projects into the broad ligament. It is distinctly encapsulated, moderately firm, and largely necrotic. The tubes and ovaries are normal.

The chief gross features of this case are the presence of a large tumor originating over a wide area, without deep involvement of the musculature, extensively necrotic, and infected, and causing considerable enlargement of the uterus.

Microscopical examination. Large sections from different parts of the mass revealed surprisingly few living tumor cells. The bulk of the growth is made up of masses of necrotic tissue, fibrin, blood, and pus. The only living cells are found in the inner layers and surface of the musculature, where they appear in considerable masses, lying between muscle fibers and surrounding or occluding sinuses. The line of infiltration by these cells ends rather abruptly, but the tumor and the remaining musculature are everywhere extensively infiltrated with pus and serum. The remains of the decidua are probably included in the tumor but it is impossible to identify any decidual tissue or traces of villi.

The tumor cells are large or giant acidophile cells with single or multiple vesicular, or pyknotic, or fragmented nuclei, without traces of mitosis. They are especially abundant about the walls of sinuses. They are so abundant in places as to suggest a neoplastic hyperplasia, were it not for the evident signs of nuclear degeneration and the irregular distribution. The invaded muscle cells undergo atrophy, the terminal stages resembling the tumor cells. New œdematous cellular connective tissue infiltrated by isolated wandering cells appears in some quantity. See Fig. 16.

Summary of features of atypical chorioma. From the recorded cases, the atypical chorioma appears as a highly characteristic process closely related to the tumors of the chorion, but differing essentially from the two main types of these tumors. In the gross the uterus is much enlarged, often to greater dimensions than are seen with other forms of chorioma. The growth arises from a large area or involves

almost the whole internal surface, as in Cullen's case, or it may be limited to a relatively small area of the uterine mucosa, as in v. Velit's case. It may produce one large intrauterine mass or more often appears as irregular globular masses surrounding the enlarged uterine cavity. It is doubtful if it ever perforates the uterus, but as in the present case secondary tumors may arise from emboli in the uterus or broad ligament. Fleischmann reports a metastasis in the vagina, showing the structure of atypical chorioma, but it is possible that the original condition was one of deported villi, whose cells underwent this form of regression. It is doubtful if genuine progressive metastases ever occur from this type of chorioma.

Microscopically the structure is extremely characteristic. As detailed above, the growths consist of irregularly distributed groups and diffuse masses of large or giant syncytial wandering cells, whose minute structure suggests a form of degeneration with proliferation, cell fusion, obstruction and thrombosis of vessels, and necrosis. Definite syncytium, Langhans' cells, or villi, are missing, but Fleischmann pictures a few islands of rather typical syncytium among a large number of wandering cells.

Much of the bulk of these masses may be contributed by coagulated blood and fibrin mingled with pus, and by the infiltration of the muscularis and especially of the walls of dilated sinuses with wandering cells, exudate, and inflammatory cellular tissue.

The origin of these wandering cells, and their abundance in necrosing portions of malignant choriomata, explain the occurrence of transitional forms between pure atypical chorioma and choriocarcinoma or adenoma of which there are many examples in the literature, and in which one finds increasing proportions of well formed syncytium and of Langhans' cells. Processes which exhibit budding syncytium and Langhans' cells must be rigidly excluded from the present group.

The prognosis is essentially favorable. As the life span of the wandering cells is limited, this process advances slowly, it gives ample warning of its presence by considerable enlargement of the uterus and frequent hæmorrhages, it seldom perforates the uterus, and progressive metastases have apparently not been observed. Yet there are serious dangers connected with its course and many of these cases are fatal. In Schmauch's list about five per cent of the fatal cases were of this type. Hæmorrhage, local and general infection, peritonitis, and perforation during curettage, are the chief causes of death.

The treatment, assuming that the diagnosis is correctly established, must vary with the local and general conditions. This is the condition for which Menge has said that it is a crime to remove the uterus. Nevertheless, when the uterus has been removed it has usually been found to be so extensively invaded that it is doubtful if it could ever have been restored to a safe or physiological condition. Yet the numerous recoveries after curettage (Menge) show that this should be the first procedure in cases which are not too far advanced or too seriously complicated by hæmorrhage or infection. When the disease has greatly enlarged and extensively invaded the uterus, or when there are severe hæmorrhages, anæmia and cachexia, or grave infection, hysterectomy would seem to be the only adequate method of dealing with it.

The question remains as to the true pathological nature and position and a suitable nomenclature of this process. The term atypical chorioepithelioma has become established by several years of general usage, but it was introduced at a time when the exact pathological and clinical characters of the process were imperfectly recognized, and it can hardly be claimed that it meets the present requirements. These requirements are theoretical and practical. From the pathological standpoint one has here to deal with a peculiar process quite distinct in most instances from a progressive neoplasm, and differing widely from the more malignant forms of chorioma. There does not appear to be any parallel among pathological conditions for this peculiar limited but destructive proliferation of syncytial wandering cells. It has some of the characters of a productive inflammation which would be indicated by such a term as "syncytial endometritis," but when it displays qualities approaching the neoplastic or occurs outside the uterus this term becomes inadequate. Yet

to designate such a process as chorioepithelioma, however modified, appears to the writer a more palpable misnomer.

Practically the requirements for a specific term for this process are more urgent. A disease which exhibits highly characteristic gross and microscopical features, pursues a unique clinical course, carries a modified prognosis, and requires a specially adapted line of treatment, would seem in the interests of the patient to deserve a specific name.

In the absence of a wholly suitable term, the writer has become accustomed to think of the milder cases of this group as a form of *syncytial endometritis*, and he therefore suggests that the employment of such a term is preferable to the present usage.

For those cases in which the process shows more definite characters of a neoplasm, the term *syncytioma* has been employed and commends itself, for reasons which require consideration in some detail.

TRANSITIONAL SYNCYTIAL CHORIOMA. SYNCYTIOMA

Attempts to sharply subdivide and classify closely related pathological processes usually encountered difficulty from the occurrence of transitional cases intermediate between the definite groups. The occurrence of such transitional cases in the field of chorioma, while not affecting the validity of the plan of classification requires special notice, for it is in regard to this class of cases that much confusion has arisen.

The transitional cases of chorioma stand between choriocarcinoma and chorioadenoma on the one hand and syncytial endometritis on the other. It has already been noted that in some cases of chorioma composed of both syncytium and Langhans' cells, the former cells greatly predominate, while the latter are relatively few in number and of reduced vitality. It is probable that there are all gradations between choriocarcinoma or adenoma and syncytial endometritis, and that the transition is marked by progressive increase in the proportion of syncytium and decrease of Langhans' cells, while at the same time the proliferating syncytium is gradually replaced by syncytial wandering cells. To what extent this transformation may occur in any given tumor is not clear, but it is reasonable to suppose, following the rules established for transplantable tumors in lower animals, that there are cyclic variations in the growth energy of choriomata, and that if favorable factors such as partial removal or improvement in health intervene at the periods of growth depression, some of these tumors may spontaneously regress, the regression being marked by the morphological changes above described. Numerous reports of the conditions under which such regressing choriomata are observed seem to require the admission that some of these tumors may progress for a time and then losing the power of further development undergo a process of regression marked by the overproduction of syncytial cells and degeneration of Langhans' cells. If examined histologically during the period of regression such a tumor would be found to have produced lesions which it would have been impossible of causing in its observed histological form, and such a tumor would prove less malignant than would be expected from the extent of its growth, and the structure or portions of the tumor.

It seems to the writer that the conception of partial regression of uterine choriomata is required by the clinical observations in this field, for in nearly all the cases in which the clinical course was said not to accord with the histological structure that structure has shown the features of transitional syncytial chorioma, indicating partial regression.

v. Velits has submitted to careful analysis many of the cases of unexpected recovery from chorioma after partial removal of the tumor, (Marchand, Kolomenkin, Noble), or after curettage, or spontaneous expulsion of a uterine tumor, and shown that nearly all these cases showed histological signs of partial regression.

The relatively favorable prognosis of choriomata of the syncytial type is also clearly apparent in Schmauch's analysis. It is difficult to determine just what forms of chorioma are subject to the regressive changes designated as transitional or syncytial chorioma. It is evident that some of the cases showed many of the features of choriocarcinoma, since villi were absent and syncytium and mitotic Lang-

hans' cells abundant. Yet the writer is strongly of the opinion that the change rarely if ever affects in pronounced degree the highly malignant choriocarcinomata with extensive metaplasia of Langhans' cells and syncytium, and that it is practically limited to the chorioadenomata. Some of the reasons for this conclusion are as follows:

The gross, microscopical, and clinical features of chorioadenomata closely approach those of syncytial chorioma. In the gross chorioadenoma produces local or pulmonary but not general metastases. In structure chorioadenoma usually shows a preponderance of syncytium and if one eliminates the stroma of villi it is a short step from the complete picture of chorioadenoma to syncytial chorioma. Chorioadenoma possesses only moderate malignancy, sometimes regressing after partial removal (cases, Zajorganski-Kissel, Kworostansky, Lonnberg, Mannheimer, Neumann-Schauta). It therefore belongs to a type of tumor which, like syncytial chorioma, displays a tendency toward spontaneous regression. In fact the writer would class many of the cases reported as syncytial chorioma in the group of chorioadenoma without villi.

On the other hand, the gross, microscopical, and clinical features of true choriocarcinoma differ sharply from those of syncytial chorioma, and the common behavior of choriocarcinoma does not favor the belief that it may ever spontaneously regress. Yet regressive changes occur in some portions of highly malignant choriomata, and it does not seem possible by an analysis of the literature to determine the exact limits of the occurrence of pronounced transitional changes in chorioma.

It remains an open question whether the occurrence of transitional cases does not deserve to be emphasized by the formal classification of these cases in a fourth group of choriomata. Several considerations seem to weigh against such a plan. Slight regressive changes occur in some parts of the most malignant choriomata without affecting the prognosis. The occurrence of regressive changes does not constitute a specific histological type which alone can form a legitimate basis for the classification of tumors.

Different degrees of regressive changes influencing the prognosis affect both the well defined types of chorioma, so that a new group created on this basis would not exclude the others. The terms syncytial chorioma or syncytioma therefore seem to find a place in designating certain regressive changes occurring chiefly in chorioadenoma, which are of much practical importance in prognosis.

BIOLOGICAL PECULIARITIES OF CHORIOMATA

That the clinically significant features of tumor growth are often determined by the physiology of their cells of origin is nowhere more conspicuous than in the group of chorioma. The unique physiological position of the chorionic epithelium is paralleled by several remarkable features in the tumors derived from these cells, which it is of interest and importance to consider in some detail. Moreover, the evidence bearing on some of these peculiarities is rather fragmentary and inconclusive so that it seems desirable to consider at this time what one can believe regarding some of the distinguishing qualities of choriomata.

(*a*) *The deportation of normal chorionic elements and their fate.*

That syncytial masses are often carried from the uterus and lodged in the pulmonary and other capillaries was first shown by Schmorl for cases of eclampsia and later for normal gestation. Such emboli are commonly recognized to some extent in the lungs of most subjects dying during gestation. Schmorl found them in eighty per cent of 158 cases.

Most of the emboli consist of single syncytial masses which exhibit as a rule signs of absorption by the pulmonary cells. In this form they are not always to be distinguished from other embolic cells, especially those derived from the bone marrow, but there is no doubt that deportation of syncytial masses occurs in probably all normal gestations and often at an early period. Lately, however, Schmorl has somewhat informally stated, and his pupil Dunger (l. c., p. 340) has substantiated him more fully, that portions of whole villi including the stroma may occasionally be found in the pulmonary and pelvic vessels. This event occurs only when considerable force has been employed in the delivery.

This observation I believe has not yet been confirmed, but the possibility of its occurrence suggests a cause for some of the pulmonary thromboses of parturition.

Occurring in all pregnancies, the usual fate of such deported cell masses must be absorption, but in two cases of abortion and in three of simple hydatid mole, Dunger described proliferative changes in the embolic cells. In some cases the proliferation was recognized by a comparison of the embolic cells with those found in the uterus, a method of judgment which is perhaps somewhat uncertain, while in other cases the cells seemed to be breaking through the wall of the occluded vessel.

Schmorl believes that transitory proliferation of embolic syncytium occurs rather frequently in the lung, and he describes small cicatrices in this organ which seemed to have resulted from the final absorption of such groups of cells.

If these observations are reliable then it would appear that epithelial cells from the normal chorion or from moles which completely regress after expulsion are sometimes capable of multiplying and growing in the lung.

That this capacity is not limited to placental cells is shown by the old experiments of Conheim and Maas, who constantly saw proliferation followed by regression of rabbit's periosteum injected into the jugular vein and lodging in the lung.

That benign moles may give rise to benign metastases is further shown by an observation of Pick's, who in a case of simple hydatid mole found a vaginal tumor containing a dozen segments of villi with hyaline stroma and syncytium largely necrotic. The outcome of this case was not known, but Pick based a favorable prognosis on the degenerated state of the cells.

These observations on the frequency and extent of deportation of chorionic structures throw new light on the significance of metastases in choriomata; especially on the occurrence of benign metastases. They emphasize the fact that the occurrence of such metastases is not necessarily a grave event.

(*b*) *Can malignant tumors develop from the deported normal or originally harmless cells of the chorion and placenta?*

The discovery of increased proliferative powers of embolic cells derived from simple moles and the placentas of abortions raises the question how far may such proliferation go. Pick thinks that a harmless uterine mole may give rise to metastases and these later turn malignant. He bases this view on the observation of regressing villi in a vaginal tumor, and on the claim that the histology of vaginal metastases which regress and those which prove malignant may be identical. He refers to Apfelstedt's case in which vaginal metastases that proved malignant had the same histological structure as others which were known to have regressed. But in Apfelstedt's case both the uterine tumor and the vagina metastases had the structure of chorioadenoma, not that of normal villi, and there is no indication that the metastatic cells in this case developed malignant qualities after lodging in the vagina. It may be granted that embolic cells of these, as of other tumors, show increased powers of growth but there is as yet no histological proof that the embolic cells of normal villi or of simple hydatid mole may become malignant. Schmorl reports a case of malignant choriocarcinoma in the organs, appearing first in the vagina, developing eighteen weeks after normal pregnancy with a normal uterus. Although the placenta in this case was not examined, Pick claims that this case proves that a malignant tumor process may appear first in embolic cells. McCann reports a case in which the disease was said to have arisen nine years after the last normal labor, yet an abortion occurred only three months before. The presence of a normal uterus does not exclude the possibility of chorioma developing in an ectopic sac as has occurred in thirteen reported cases. The above references form the basis of the view that malignant chorioma may develop in the organs from embolic normal cells while the uterus remains free. It is obvious that the proof of such an event is defective. Schmorl inclines to doubt such a possibility, and since the placentas were not examined in the suspected cases he thinks that a partial mole must exist before an ectopic chorioma can develop. That partial hydatid degeneration is very common is shown by Stoerk who reports that four-fifths of abortive placentas show such changes. In a

series of abortions examined by the writer, hydropic degeneration of the villi was always present but proliferation of cells was usually slight. In none was there any definite tumor process in the villi. Since malignant chorioma has repeatedly occurred after normal labor at term, andw hen thus arising has an unusually bad prognosis, and since it is very unlikely that a malignant mole can leave the uterus entirely free, it must be admitted that there is a suspicious set of circumstances suggesting that highly malignant chorioma may develop from deported normal placental structures. Marchand has practically accepted this conclusion. It may be suggested that this entire subject of the fate of deported placental structures is open to experimental investigation. At present the experimental data offer no support to the alarming conception that the pregnant woman may fall a victim to emboli of normal cells. The occurrence of chorioma of teratomatous origin must also be considered in these cases.

(*c*) *Recovery from chorioma after occurrence of pulmonary metastases.*

In 1905 Fleischmann collected seven cases of recovery after the probable occurrence of metastases in lungs as reported by Chrobak, v. Franquè, Zagorjanski-Kissel, Ladinski, Neumann-Schauta, and Pestalozza. The evidence of pulmonary metastases consisted in the symptoms of cough and hemoptysis. While the lungs were necessarily not examined histologically and no tumor fragments were found in the sputum, there seems to be no reasonable doubt that in these cases cell emboli occurred and were eventually absorbed. This conclusion has been rendered more acceptable by what has since been learned about pulmonary emboli from the normal placenta and of their usual fate. Yet it is possible that some of the emboli consisted only of fibrin.

That recovery may follow the development of vaginal metastases is clearly shown by the list of thirteen such cases collected by Schmauch. To these may be added two similar cases reported by Neumann and Kolomenkin. In some of these the uterus and vaginal nodules were removed, in others only the uterus was removed, while in the cases of Fleischmann, Hörrmann, and Kolomenkin neither uterus nor vaginal nodules were completely extirpated.

It is therefore evident that neither pulmonary nor vaginal metastases carry a necessarily fatal prognosis, although it should be emphasized that the great majority of patients with cough and hemoptysis die. The gravity of vaginal metastases is considerably the less serious, and the occurrence of quite harmless vaginal emboli of cells and villi should be kept in mind.

It is in this field of vaginal metastases that much conflict of opinion has arisen regarding the value of histological examination of the excised tissue. Yet the writer finds that a study of these case reports clearly indicates that pulmonary and vaginal metastases of favorable course belong to the group of chorioadenoma or syncytioma and not to choriocarcinoma, and that histological examination is of much value as a guide to prognosis. Thus in fifteen such cases I find that in nine villi were present, in three (Fleischmann, Kolomenkin, Hörrmann) the growth was atypical, in two the description is indefinite. Yet in Schlagenhaufer's case the structure was possibly that of choriocarcinoma, although syncytial cells were very abundant and extremely vacuolated as in chorioadenoma, and the nodule was small. The uterus was normal.

(*d*) *Recovery from chorioma after curettage.*

In 1904 v. Velits collected eight cases of chorioma in which curettage was followed by recovery. I have examined the reports of these cases and find that in five, masses of proliferating Langhans' cells were absent and the growth was composed chiefly of large wandering syncytial cells. These five cases therefore fall in the group of syncytioma or syncytial endometritis, for which Menge recommends curettage as the operation of choice. Of the remaining cases Risel's and Blumreich's were hydatid moles with active proliferation of cells — doubtful chorioadenoma. Graefe's case was inadequately described.

Here again the histological examination gave reliable indications of a tumor of moderate potential malignancy. That curettage is an unsafe measure in dealing with true tumors of the chorion is shown by the high mortality accompanying curettage, even when promptly followed by hysterectomy. The gross anatomical conditions, existing with choriocarcinoma

or chorioadenoma are hardly favorable for complete removal of the growth by the curette.

(*e*) *Recovery from chorioma after partial removal of the uterine tumor.*

In cases reported by Marchand, Noble, Kolomenkin, Fleischmann, Hörrmann, Dunger, Cazin-Segond, the patient recovered after operation, although the tumor was not completely removed. In the cases of Fleischmann and Cazin-Segond the growth contained only syncytial wandering cells. In the cases of Marchand, Kolomenkin, and Hörrmann masses of proliferating Langhans' cells were missing and the tumors are difficult to classify, but were chiefly of syncytial nature. In Dunger's case there was recovery after early hysterectomy for chorioma, but a vaginal tumor arising later and of undetermined nature spontaneously regressed. The case is apparently similar to that of Schlagenhaufer, and points to the possibility that an isolated metastasis of choriocarcinoma may spontaneously regress. In the recent work on the transplantation of tumors in mice it has been possible to distinguish between a premetastatic and a metastatic period. In the cases above cited, one may suppose that the organism was susceptible to the growth of the original tumor but insusceptible to the implantation of metastases. In Noble's case, the size of the tumor, 8 x 8 x 7½ cm., indicates that it did not belong to this more malignant group of choriomata, while the structure showed a preponderance of syncytial cells, and islands of Langhans' cells appear to have been missing.

(*f*) *Primary ectopic chorioma.*

The occurrence of primary ectopic chorioma with the uterine mucosa free from involvement was first observed by Schmorl after normal labor and by Pick after an hydatid mole. Pick drew the conclusion from these cases that embolic cells of a harmless mole might develop a metastatic tumor, while Schmorl inclined to the opinion that such ectopic choriomata must be metastases from an original intrauterine tumor.

In 1902 Zagorjanski-Kissel collected sixteen cases of primary ectopic chorioma, to which may be added Dunger's case and that of Davis and Harris. Five of these (Schmorl, Fiedler, Lindfors, Wehle 2) occurred after normal labor and were fatal (choriocarcinoma). Since the uterus was normal or showed only moderate changes it is difficult to escape the conclusion that the tumors arose from deported normal cells. Yet, as the placenta was not examined it remains possible that an early tumor process existed in the placenta before expulsion. Marchand's fatal case of ectopic chorioma was preceded by hydatid mole and presented the structure of choriocarcinoma.

Seven of the eighteen cases recovered, three of the type of chorioadenoma (Zagorjanski-Kissel, Schmit, two cases): one with predominance of syncytial cells (Guerard); and one the anomalous case of spontaneous recovery from vaginal choriocarcinoma (Schlagenhaufer). In Holzapfel's case the structure was not detailed, while in Pick's case the deported villi were degenerating and probably not of neoplastic nature. Eleven of the eighteen cases were fatal, with general metastases, and actively proliferating syncytium and Langhans' cells.

In this group of cases the relatively favorable prognosis of chorioadenoma and the unfavorable significance of the structure of carcinoma with proliferating Langhans' cells, reappear. The grave prognosis attaching to cases arising after normal labor is also supported by five of this group, all of which were fatal.

Tubal pregnancy has given rise to chorioma in thirteen reported cases (Marchand, Sneginew, Nikiforoff, Thorn, Rosner, Gebhard, Albert, Hinz, two cases; Senarcleus, Vasmer, and Risel). Twelve of these were collected by Risel and to his list has since been added one case by Garkisch.

All of these were fatal except Albert's case, and all presented the structure of choriocarcinoma or adenoma.

Senarcleus reported his case as atypical but yet describes many mitoses in small clear cells, together with syncytium.

The diagnosis of tubal chorioma was based upon the presence of a large tumor distending the tube or broad ligament and lying wholly outside the uterus, while the uterine mucosa was unaffected.

Ovarian pregnancy seems to have been the origin of the fatal choriocarcinoma described by Kleinhans.

(*g*) *Chorioma of teratomatous origin.* In dealing with primary ectopic chorioma one must consider the possibility that the tumor may be of teratomatous origin and wholly unconnected with pregnancy. In the male subject many cases of generalized chorioma are recorded as secondary to primary teratoma of the testis. In a few instances, as in that of Bostroem, tumors of the same character have not been traced to the testicle and their site of origin remains obscure. In the female also a few cases of chorioma have been described as occurring under conditions which seem to preclude the possibility of pregnancy. Such a case is that of Lubarsch, who observed an abdominal chorioma in a virgin of thirteen and a half years, who had never menstruated. Other cases of chorioma in the female probably not connected with pregnancy are reported by Pick and by Bock.

With few exceptions the cases of primary ectopic chorioma in the female have been clearly derived from an ectopic pregnancy and a definite gestation sac or a uterine pregnancy were demonstrated, but in a few cases this connection has not been conclusively shown. In the absence of other unmistakable evidence of pregnancy chorioma may have to be referred to a teratomatous origin.

(*h*) *The general prognosis of chorioma.*

The high mortality of chorioma and the relation of the mortality to the preceding condition is well shown by Teacher's statistics.

Preceding Condition	Total	Deaths	Recoveries	Percentage of Recoveries
Hydatid Mole	73	39	34	46.6
Abortion	59	38	20	33.9
Labor at Term	49	39	10	20.4
Tubal or Ovarian	7	5	1	....
Total	188	121	65	34.2

In these 188 cases radical operation was performed 99 times with 63.6 per cent of recoveries. After operation recurrence was noted within six months or not at all, except in five cases. In one case (Loblein) recurrence was postponed for one year. The high mortality in cases following labor at term is very striking.

The relation of mortality to histological structure I have endeavored to trace in the cases collected by Schmauch, but it is often difficult to determine the exact structure from the histological report of the authors. In 108 fatal cases 79 (73 %) may be classed as choriocarcinoma. By the same criteria out of 94 recoveries 17 (18 %) belonged in this same group. In most of these it is difficult to determine just what histological signs of malignancy and metaplasia existed, but many of them showed a marked preponderance of typical syncytium and relative deficiency of proliferating Langhans' cells.

Of 65 fatal cases with general metastases collected by Schmauch all showed the structure here designated as choriocarcinoma. Among the fatal cases with metastases limited to the lungs and vagina are many in which syncytial cells were the predominating form and Langhans' cells deficient, and several chorioadenomata occur in this group.

While there are recorded many fatal cases of chorioadenoma or atypical chorioma (infiltration by syncytial wandering cells) in reviewing the histories of these cases one must be impressed by the frequency with which hæmorrhage, infection and cachexia, and not the progressive growth of the tumor, prove to be the cause of death.

There is thus a very definite relation between the histological structure of these tumors and their clinical course. While this relation is not so uniform with chorioma as with some other forms of carcinoma, yet it appears too obvious to justify the extravagant statement that histological examination gives no indication of the future course of the disease. I believe that the recognition of the three classes of tumors here suggested, choriocarcinoma, chorioadenoma, and syncytial endometritis or syncytioma, would further the establishment of a definite potential malignancy for each group.

In considering the prognosis of any malignant tumor one must distinguish between potential malignancy and clinical course. The potential malignancy can be accurately judged only

by the histological structure, but the clinical course is subject to great variations from external factors which are unrelated to the potential malignancy. Many early but highly malignant cancers of the tongue, uterus, and breast are cured by operation. There is an increasing list of spontaneous recoveries from highly malignant tumors, while the spontaneous regression of certain partially removed ovarian adenocarcinomata is the rule. If the histological structure of the regressing choriomata were more carefully compared with that of the progressively fatal ones and exact standards of histological malignancy were employed, I believe that it would be found unnecessary to except chorioma from the general rule of a clear relation between structure and prognosis.

BENIGN CHORIOMA

An active discussion has been carried on by v. Velits, Meyer, and Hörrmann regarding the possibility of recognizing a benign form of chorioma.

v. Velits maintained that it is possible to recognize histologically those tumors which will progress favorably. The signs on which he relied are (1) absence of mitoses in Langhans' cells; (2) signs of degeneration in these cells and in syncytial masses, and (3) comparative or complete absence of Langhans' cells. Meyer goes much further and would recognize a malignant chorioma only in the presence of (1) invasion of the musculature by thick masses of cells; (2) a considerable proportion of Langhans' cells in active mitosis; and (3) leucocytic reaction, necrosis, and thrombosis. In studying the pregnant uterus in pathological conditions associated with placental retention he found a bulky growth of epithelium well within the musculature but without active mitosis in Langhans' cells or leucocytic infiltration. He states that as long as villi are found the discovery of epithelium deep in the muscle or even breaking through the vessel walls may signify a harmless cell invasion and should suggest placental retention rather than a malignant tumor. In such cases he would wait three weeks for a second curetting in order to determine the existence of a persistent tumor process.

Hörrmann attacks all these conclusions of v. Velits and Meyer. In a case he reports, mitoses in Langhans' cells were very abundant and yet the patient recovered. He concludes that chorioma in the musculature loses its characteristic cell types because the Langhans' cells lose their vitality or cease multiplying altogether. Langhans' cells, he thinks, are not necessary for the picture of malignant chorioma, and syncytial wandering cells are by no means harmless elements when found alone in these tumors. He goes so far as to say that complete absence of Langhans' cells means nothing for prognosis, while their appearance in compact masses does not indicate malignancy, since he saw such masses in a case which spontaneously recovered.

As a comment on this discussion one may point to the above statistics, which show that tumors of the type of choriocarcinoma are almost always if not invariably fatal, that a considerable proportion of the type of chorioadenoma, and a still larger percentage of transitional cases recover, some of them spontaneously, while with syncytial endometritis curettage, according to Menge, is the operation of choice. It should be noted that Hörrmann based his conclusions on the examination of curettings, while Meyer reports a study of the whole uterus. Two curettages cured Hörrmann's case in spite of an unremoved vaginal metastasis, a result which was foreshadowed by the evident signs of regression in the tumor, syncytial chorioma, infiltration of the muscle only by wandering cells, and freedom of the sinuses from tumor masses. Langhans' cells may be absent in some fatal choriomata, but contrary to Hörrmann they are universally recognized as an essential element in the highly malignant tumors.

v. Velit's signs of reduced malignancy, especially the predominance of atypical regressing syncytium, and comparative or complete absence of Langhans' cells have been commonly accepted as belonging to tumors of low potential malignancy with a regressing tendency, but their existence does not assure that the patient will escape all the accidents belonging to such conditions.

None of the above writers seems to have considered the histological signs indicating the degree of cellular metaplasia, yet these become very distinct in the more malignant tumors and furnish a most reliable prognostic criterion. However difficult it may be to recognize the favorable cases, most of the definite choriocarcinomata present unmistakable histological signs of great malignancy. (See case 6.) Fig. 12.

The element of individual resistance has justly been given a very prominent place among the factors determining the prognosis of chorioma. There is clinical and experimental evidence that hæmorrhage, infection, cachexia, and the pregnant state exert a pronounced

influence on the growth of tumors and the development of metastases. Zajorganski-Kissel especially has emphasized the importance of this factor in chorioma, and would even attribute to it almost exclusively the determination of the course of these tumors. Yet it has never been shown that any constitutional condition sharply influences the inception of tumors or their original potential malignancy, and it appears very doubtful if the constitutional element exerts any greater influence on chorioma than upon some other tumors. Cancer of the breast arising in pregnancy usually shows a malignancy quite equal to that of the most rapid chorionic carcinoma.

When one considers the brief life span and unusual forms of growth of the chorionic epithelium and the complicating factors of gestation, anæmia, and sepsis, it would seem that a sufficient explanation were furnished for all the observed clinical peculiarities of choriomata. If any peculiar factor is present in this group of tumors it is in the writer's opinion to be found in the relations of lutein secretion to the chorionic epithelium.

(*i*) *Relation of corpus luteum secretion to chorioma.*

Although Wilton, in 1840, described cystic changes in the ovaries in a case of malignant hydatid mole, and many have since reported similar cases, only in recent years has any reasonable hypothesis been offered to explain this combination of lesions. In 1895 Marchand pointed out the notable frequency of ovarian cysts with chorioma. In 1901 Stoeckel showed that many of these cysts are developed from corpora lutea, and are accompanied or preceded by a more or less diffuse infiltration of the ovary with lutein cells from which the multiple cysts probably arise. So extensive was this infiltration that Schaller-Pförringer considered the possibility of its cancerous nature. Many details of the structure of the cysts were given by Fraenkel, Orthmann, and Jaffe. In 1903 Fraenkel concluded from experiments on animals and clinical observation that the function of the corpus luteum is concerned with the implantation and growth of the fertilized ovum, and that such implantation fails to occur when the corpus luteum is excised. Frankel thought that death of the ovum, hydatid mole, and chorioma might result from interference with the function of the corpus luteum.

At the same time Pick suggested the theory that the corpus luteum secretes a specific nutritive substance which presides over the growth of the ovum, and that an excess of this secretion may be responsible for the excessive growth of cells in malignant chorioma.

Seitz, Grouzdew, and Wallert, have doubted the importance of the relation of corpus luteum cysts and chorioma.

Seitz, in an extensive material, traces the origin of the cysts to the atresic follicles of the ovary and endeavors to prove that the hyperplastic cells of these follicles are of quite different significance from those of the true corpus luteum with which Fraenkel's experiments were concerned. He finds that the atresic follicles begin to hypertrophy in the sixth week of normal pregnancy and progress until term. He doubts the dispersion of lutein cells throughout the ovary and considers that stroma cells give rise to the islands of tissue resembling lutein cells. He thus draws a sharp distinction between cysts of true corpora lutea and the polycystic condition of the ovaries in gestation and hydatid mole. He claims that there is no important distinction between the polycystic condition in normal pregnancy, mole, and chorioma, and ventures to state that the size of the cysts in chorioma is of no great significance, since the larger the cysts the less is their content in lutein cells. The great size of the cysts in chorioma he refers to mechanical factors, as venous congestion from adhesions, chronic nephritis, etc.

Wallert observed that hyperplasia of the cells of the internal layer of the corpus luteum is characteristic of pregnancy, and found that cysts of this type occur without hydatid mole or chorioma. He collected several cases of pregnancy without moles or chorioma, in which cysts were almost as numerous and large as he found in a certain case of chorioma. He reports one case of fatal chorioma with small ovaries, but the report shows in one ovary cysts of the size of a cherry.

Dunger, a pupil of Schmorl's, regards the ovarian cysts as a secondary effect of the active growth of chorionic cells and classes them with

hypertrophy of the breast and other nutritional changes of pregnancy.

Nevertheless the primary importance of ovarian secretion in chorioma and the theories of Fraenkel and Pick have not been disposed of. The minute studies of L. Fraenkel, Stoeckel, Orthmann, Pinto, Jaffe, and others, leave no room for doubt that the cysts arise from corpora lutea, vera, and spuria, and from disseminated islands of lutein cells, as well as from atresic follicles, and that however arising they contain lutein cells in great excess. According to the character of the lining cells the cysts fall into four classes, which represent transitions of essentially the same structure: (1) Cysts lined by hypertrophic lutein cells. (2) Cysts lined by connective tissue in which the original epithelial lining has been lost. (3) Cysts lined by connective tissue covered by flat or endothelial cells. (4) Cysts lined by lutein cells covered by cylindrical, cuboidal, or flat epithelial cells.

In normal pregnancy somewhat similar but much less extensive hypertrophy of lutein tissue occurs, but, as Seitz admits, these changes are limited to pregnancy, hydatid mole, and chorioma. A pronounced degree of the characteristic changes is practically limited to hydatid mole and chorioma.

The association of advanced polycystic degeneration of both ovaries with hydatid mole and chorioma is very frequent if not invariable. In 1905 Patellani reported that in 68 fully described cases of chorioma to that date bilateral cystic changes in the ovaries occurred in 62, or 91 per cent.

That early cystic changes may readily be overlooked was pointed out by Jaffe, and is shown by the writer's experience in his case 7. Here the ovaries in the gross appeared entirely normal, but on section they were found to be riddled with small cysts. Some of these were cysts of atresic follicles with hypertrophied lining cells; others were cysts of old corpora lutea in many stages and showed much hypertrophy of the large epithelioid cells. Considerable areas of the ovary contained groups of these epithelioid cells as described by Stoeckel, and their total bulk greatly exceeded that found in normal pregnancy. This observation shows that cases in which the ovaries have not been examined microscopically for this particular purpose must be eliminated from the present discussion. Moreover, it is obvious that a hypersecretion may exist in ductless glands without the formation of cysts, and we have yet no method of determining the activity of ovarian secretion.

Judging by analogy with other ductless glands, as the thyroid, or the islands of Langerhans, an excessive secretion and its associated histology in one subject might be deficient for the needs of another organism, while the influence of the age of the patient, the number and period of the pregnancies, and other individual pecularities, must determine the requirement and influence the course of ovarian secretion.

While Seitz' admirable observations have succeeded in demonstrating that the chief origin of the multiple cysts may be from the atresic follicles, his argument that the condition in the ovaries in chorioma has no other significance than that of a slightly exaggerated normal process is plainly defective. The astonishing grade of cystic degeneration common with chorioma is not duplicated in any other condition, and mechanical factors cannot be held responsible for such extensive changes. Chronic congestion does not produce ovarian cysts, while very extensive grades of cystic change occur when the uterus is but slightly enlarged (see Fig. 10). Contrary to Seitz' surmise the bulk of active lutein tissue in the average case of chorioma enormously exceeds that of normal pregnancy. His chief argument is based on the supposed difference in origin and function of the lutein cells of the corpus luteum and the hyperplastic cells of the atresic follicles. Yet the uncertainties surrounding the origin of the cysts and the relation of their lining cells cannot obscure the fact that the cysts once developed contain a great increase in lutein tissue. Wallert in a recent study has reached this same conclusion. On the point of origin of the cells in question, Seitz' view is by no means proven, and he admits that there are transitional cysts bridging the apparent gap between corpus luteum and the follicular type.

Dunger's idea that the cysts develop as a secondary effect in the general nutritional

changes of pregnancy is irreconcilable with the fact that advanced cystic ovaries are almost never seen in normal pregnancies. While it is said that bilateral cystic ovaries have been found without hydatid mole or chorioma, such cases are extremely rare and the identical character of the cysts may be doubted.

In view of these facts and of the occurrence of peculiar bilateral cystic ovaries in at least 91 per cent of the cases of chorioma, it is difficult to escape the conclusion that there is some essential connection between the two conditions.

What the nature of this relation may be is at present entirely obscure. An excess, or deficiency, or altered quality of ovarian secretion, might meet the demands of the Fraenkel-Pick theory. The subject invites experimental study as the method best adapted to furnish a solution of this interesting problem.

The importance of the subject, both in the field of chorioma and for the general principles of tumor growth, is obvious. If one could substitute for the complex conception of individual resistance the idea of varying quantities of a definite physiological principle, many of the obscurities in the field of chorioma would be cleared up, and perhaps the foundation laid for exact and effective practical procedures.

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CARCINOMA OF THE PANCREAS[1]

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IT is not my intention in this short paper to present all the literature nor all the phases of carcinoma of the pancreas. However, of all the new growths of the pancreas, carcinoma is the most common. It is usually primary, but may be secondary, extending from neighboring organs, especially from the stomach. When the disease is primary, the head of the pancreas is most frequently affected, involving the ducts and not rarely including the ampulla of Vater. When the portal circulation is obstructed, ascites ensues and the clinical picture will vary according to the particular part involved. The patient is usually middle-aged and complains of vague digestive symptoms accompanied sooner or later by loss of strength and weight. Jaundice develops gradually, usually accompanied by pain, but with steadily progressing intensity. Indistinct colicky attacks, sometimes simulating a gall-stone colic, obscure the clinical history. In spite of anything that can be done in the way of medication, the jaundice deepens in intensity until the skin assumes a dark greenish hue. Long before this occurs the gall-bladder is, as a rule, more or less distended, but by the time the jaundice is complete a tense tumor may be felt in the region of the gall-bladder. From this time on the clinical picture is that of a general distress, feebleness, lassitude, emaciation, progressing steadily downward. The stools are characterized by an absence of bile.

A pancreatic diabetes may be present, indicating that the glands of Langerhans are involved.

The principal condition from which carcinoma of the pancreas must be differentiated is chronic pancreatitis. A diagnosis is of the very greatest importance, on account of the gravity of the prognosis of carcinoma of the pancreas as compared with chronic interstitial pancreatitis.

There are two signs that are almost pathognomonic of carcinoma of the head of the pancreas. The first is marked jaundice and the second is a distinct enlargement of the gall-bladder. If the gall-bladder is contracted and jaundice is present, the obstruction is almost invariably due to stone. I have had one that I am sure was an exception to this rule. Courvoisier was the first to observe that dilatation of the gall-bladder always accompanied jaundice in this condition, and that it is invariably due to something else than stone. This axiom is known as Courvoisier's law.

The extreme rarity of sarcoma of the pancreas, which is always secondary and usually of the melanotic variety, needs only to be mentioned as a possible condition from which carcinoma must be differentiated.

In making a differential diagnosis of carcinoma of the pancreas, it must be borne in mind that whenever a patient past middle life develops jaundice which increases in intensity and becomes absolute, and at the same time the gall-bladder gradually enlarges to form a perceptible tumor, with the accompanying rapid loss of flesh and strength, carcinoma of the pancreas should be suspected. There are occasional exceptions to this rule, as was the case I mentioned above, and of which I will give the history directly.

The absence of tenderness over the lower right costal margin, together with the presence of a pulsating epigastric tumor, a tumor which does not move with respiration, tend to verify the diagnosis of carcinoma of the pancreas.

In cholelithiasis there is the history of gall-stone colic, jaundice, and sometimes fever. There are pain and tenderness in the region of the epigastrium, but there is, as a rule, no emaciation, at least not until later in the course of the disease. In cases of chronic pancreatitis there is a long history of trouble in this region, with loss of flesh — gradual, not abrupt, as in the case of carcinoma, and usually not appearing until late, long after the time usually given for the occurrence of this sign of carcinoma. The gall-bladder is seldom distended, except in the early cases. The Cammidge reaction is always characteristic of inflammation.

Cantlie, in his recent work on the stomach,

[1] Read before the Chicago Surgical Society, February 1910. See discussion, p. 429.

intestines, and pancreas, reports fifteen cases of primary carcinoma of the pancreas occurring in forty-one hundred autopsies made at the Charing Cross Hospital in London. These figures are in accord with those given by other observers.

The tumor may extend and involve the common bile duct and the pancreatic ducts. It may extend upward and forward, causing pyloric stenosis with dilatation of the stomach, or the extension may be backward so that the vena cava is compressed, causing an ascites and œdema of the lower extremities.

Pancreatic carcinoma rarely occurs before the age of forty, although a few instances are on record where it was met with in children. The schirrus columnar cell type is the most frequent form of carcinoma met with in the pancreas.

The treatment of carcinoma of the pancreas is purely surgical, and it is very unpromising at that. Villar records two cases in which he successfully performed a partial pancreatectomy. Complete removal of the pancreas was performed twice by Francke. Carcinoma of the pancreas is most amenable to extirpation when the disease is in the tail or in the body of the organ, and not in the head. Ruggi successfully removed a carcinoma of the pancreas weighing twenty-three pounds through the loin. In all probability this tumor originated from the tail of the pancreas, at least the description of the case would lead one to think so. The patient recovered and was well for three months, when evidences of recurrence were noted and the patient died six months later.

In 1894 Billroth removed the pancreas and the patient recovered. In 1895 Cade removed a tumor from the pancreas of the size of a child's head, and the patient recovered. In 1892 Terrier removed a five-pound tumor from the pancreas, but the patient died. In 1901 Francke successfully removed the entire pancreas. Of sixteen patients operated on for removal of solid tumors of the pancreas, eight recovered. In 1907 Desjardins advocated the removal of the pancreas, and, if necessary, the complete removal of the duodenum, with partial excision of the stomach, cholecystenterectomy, gastroenterostomy, and other minor procedures. Such an operation is considered feasible by competent surgeons.

In exploring the pancreas the abdomen is opened through the right upper portion of the right rectus muscle, about an inch to the right of the midline. The pancreas may be reached through six different routes:

1. Through the gastrohepatic omentum, above the stomach, a route that is especially advised in cases of gastroptosis.

2. From below the stomach, through the gastrocolic omentum.

3. From below the transverse colon, raising up the great omentum and colon.

4. Through the peritoneum, over the left of the duodenum, directly over the head of the pancreas, exposing the anterior surface of this organ and its head.

5. By mobilizing the duodenum to the left, going through the peritoneum, which binds it down, thus exposing the anterior surface of the pancreas and the right lateral portion of the head of the pancreas.

6. The tail may be reached by going through the peritoneum above the splenic flexure of the colon.

There are two great dangers in operating on the pancreas: First, hæmorrhage; second, the pancreatic secretion making its escape and causing injuries to the surrounding tissues. The pancreas is so friable that great care must be observed in clamping or ligating its tissues.

One anatomical point must be remembered in all operations on the pancreas, and that is the point which gives most excellent drainage after the operation, the left costovertebral angle, which is approached from behind on the left. In all doubtful conditions of the pancreas where merely an exploration is to be made, the median incision is probably the best. This is indicated when there is doubt as to the nature of the affection, whether it is an abscess, inflammation without pus formation, lithiasis, cysts, or carcinoma. The incision is made in the midline, above the umbilicus. If this incision is not suitable, no hesitation need be felt in making another.

CASE. I now wish to report a case which presented some points of interest. There was no gall-bladder in the case; instead there was a small pouch about the size of a thimble, so that Courvoisier's law did not per-

tain in this case. This was probably due to the fact that the patient had suffered more or less from what was supposed to be cholelithiasis for many years, and the gall-bladder had evidently then become contracted. The carcinoma in this case was situated in the head of the pancreas. It involved the ampulla and it had extended into the duodenum. The patient's history was as follows:

Mr. S., seen on February 28, 1902, sixty-two years old, American, five feet seven inches in height, weighed 155 pounds when in good health. He had lost twenty pounds in twenty-one days. In 1864 he had typhoid fever. At that time he was salivated. He had had slight rheumatic pains in a few of his joints. His family history was negative. When I first saw him he was complaining of considerable distress in the region of the gall-bladder, with pain radiating into the back, and rather persistent. He did not call it an unbearable pain. There were no attacks of hepatic colic. His illness began suddenly with a gradually deepening jaundice, intolerable itching of the skin, increasing weakness, rapid loss of weight, gastrointestinal disturbances, such as anorexia, constipation, indigestion, and clay-colored stools. He complained most of the nervous disturbances, a great restlessness, with mental depression and insomnia.

His trouble began thirteen years before, in 1889, with symptoms of indigestion and hepatic colic. He had several attacks in two years. In 1897 he had a very severe colic, and, for the first time, was jaundiced, very distinctly so. He was ill for a month, but no diagnosis was made of his condition. In 1899 he had

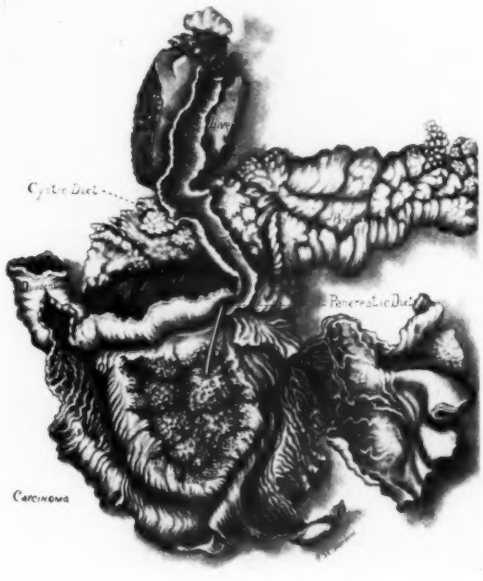


Fig. 1. Anterior view, carcinoma of the pancreas.

Fig. 2. Posterior view, carcinoma of the pancreas.

hepatic colic, with jaundice and fever. His case was then diagnosed as one of gall-stones. On February 7, 1902, he had a severe attack of nervousness, but no colic and no jaundice. It came on while he was at work and the distress became so great that he had to be taken home in a carriage. As soon as he reached home, he had a severe chill, with fever and slight jaundice. He had not lost any in weight up to that time, and felt quite well, except for occasional moody spells. Inside of twelve days the jaundice was extreme. His condition gradually became worse and he was finally referred to me on February 28th, complaining of the symptoms already mentioned.

As to the findings in the case: There was first jaundice; second, he was morose, but very quiet; third, he was very much emaciated; fourth, his temperature was 101° F., pulse 98, respiration 20; fifth, the abdomen was full and tense, with the right rectus muscle much more tense than the left. A tumor mass could be felt in two places, over the gall-bladder, but rather indefinite, and over the head of the pancreas, and rather distinct. Both masses could be felt only by firm palpation and deep percussion. Deep percussion over the mass in the gall-bladder region rather indistinctly outlined the shape of the tumor, but the gall-bladder itself could not be felt. There was distinct enlargement of the liver, and it extended upward rather than downward, above the right nipple. Tympany was general.

The other organs appeared to be normal. He passed fifty-six ounces of urine in twenty-four hours. The urine previous to this time had been very scanty. Specific gravity was 1008; .6 per cent urea, with albumin, bile, and every variety of cast; no sugar. The Cammidge test was not made. The stools were clay colored, but were not otherwise examined. The blood was negative as far as the cells were concerned, but it contained bile. A diagnosis was made of cholelithiasis and pancreatitis, and operation was advised.

As soon as the abdomen was opened, extensive adhesions were met with in the region of the gall-bladder, adhesions of the omentum, which was gathered together like a ball. It was adherent to the large bowel, stomach, liver, and anterior abdominal wall. This was the indistinct tumor that had been previously felt in the region of the gall-bladder. The adhesions were broken down and it was then that the small diverticulum previously mentioned was found in the position of the gall-bladder. This was opened and about one pint of a clear fluid was evacuated.

The liver was drained by a tube passed into the hepatic duct, and the abdomen was closed in the usual manner. The patient was transfused and put back to bed. He died on March 4th, on the fifth day after the operation.

The post-mortem disclosed a carcinoma of the head of the pancreas, with extreme dilatation of the ducts and absence of the gall-bladder. At the time of the operation the liver was split up in all directions, with the hope that a latent gall-bladder would be found, but the search proved futile.

The examination of the tissue taken from the liver, common bile duct, stomach, duodenum, pancreas, heart, kidneys, and lungs was entirely negative except for the finding of carcinoma in the head of the pancreas.

Fluid. Microscopic examination showed few leucocytes, moderate number of yeast cells, debris. Direct smears for bacteria, negative. Culture for bacteria, agar, and blood serum, negative. Agar and blood serum inoculated gave a colon bacillus. Starch added and placed in incubator. Result: No starch by iodine. Copper reduction with Fehlung. Conclusion: Complete reduction of starch.

Mixed with albumins, no trypsin action. Alkalinized and mixed with fat, put in incubator, found to be acid. Treated for fatty acids, fatty acids present. Steapsin action. Conclusion: The fluid contains pancreatic ferments.

Specimen. Gross description: The hepatic duct was widely dilated, measuring 2.5 cm. in circumference. At the point of attachment of the cystic duct was a large ragged hole. (Fig. 1.)

The common duct measured 3 cm. in circumference. It can be traced to the duodenum. Just before entering the duodenum it is joined by the pancreatic duct. These two ducts are pushed to the right by the large tumor mass in the head of the pancreas. They empty by a very minute opening in a sulcus between the mucous membrane of the duodenum and the eminence made by the tumor.

The pancreatic duct is widely dilated. Its circumference is 3 cm. The dilatation extends to the tail. In the region of the head the duct curves around the tumor mass, joining the common duct as already noted.

At the head of the pancreas is a large tumor mass. This originates below the pancreatic duct. It produces some pressure on the last cm. of the duct, compressing it and displacing it as already noted. The tumor has opened into the duodenum. (Fig. 2.) The large hole is about 6 cm. in diameter. Sections were made from this mass for microscopic examination. The omentum, mesentery, and tumor were bound together in a mass.

Microscopically. The sections show an alveolar carcinoma. The percentage of cells is large. The cells are rather small and rounded, not small for pancreas cells, but smaller than the cells of the duodenum or liver.

The stomach and duodenum present no points of interest, other than those already noted.

The heart has no bearing on the case. The kidneys, lungs, and other internal organs seemed normal. (Columbus Medical Laboratory.)

THE GROWTH OF THE BONE AGAINST RESISTANCE[1]

With Presentation of Case

By NORMAN KERR, M.D
Associate Professor Surgery, Chicago Policlinic, Chicago, Illinois

THIS paper is more or less supplementary to the one read before the Chicago Surgical Society, April 6, 1906, on Osteoplasty, in which a patient, a boy ten years of age, was presented (and he has now kindly presented himself) from whom the writer removed the diaphysis, lower epiphysis, and about one-third of the upper portion of the astragalus on account of extensive osteomyelitis of a month's duration, and after infection was controlled implanted the lower end of the fibula onto the upper surface of the astragalus, and a month later performed arthrodesis of the superior tibiofibular articulation.

Quoting from the above mentioned paper, it says, "the principal point in this case and the one which is believed to be of value in properly selected cases, is the substitution of the fibula for the tibia as the pressure bearing bone, in order that continued growth in the

[1] Read before the Chicago Surgical Society, February, 1910. See discussion, p 429.

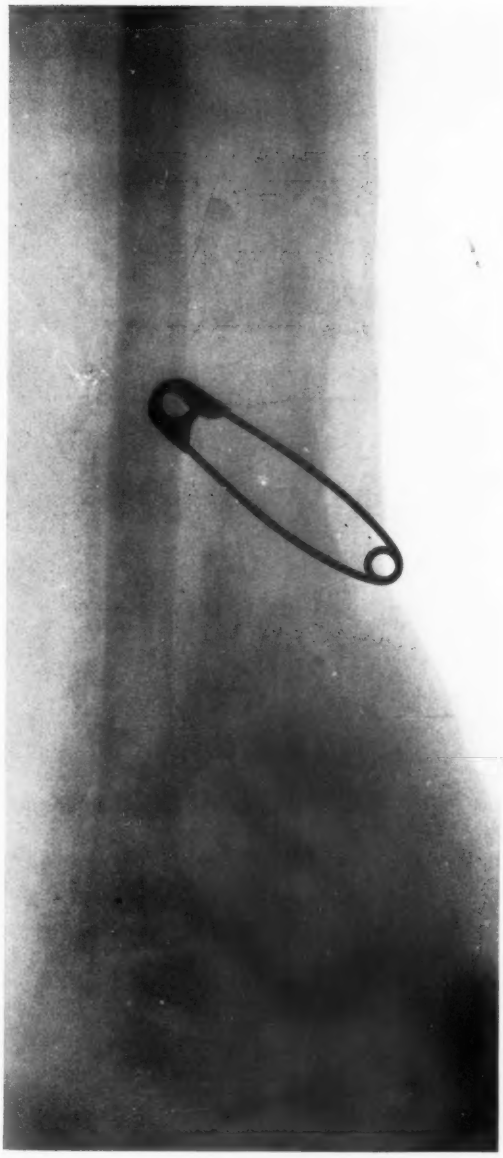


Fig. 1. Taken between Dec. 12, 1905, and Feb. 1, 1906. Amount of osseous tissue in regenerating tibia.

length of the leg may be maintained," and quoting further, "the time since the operation is entirely too short to prove absolutely whether

Fig. 2. March 9, 1906. After third operation. Showing lower end of fibula placed on remains of astragalus, also periosteum detached from fibula to act as support.

the fibula will continue to grow in length as fast as its fellow but the writer believes that it will." Quoting still further, "another advantage of this line of treatment properly carried out, is the great saving of time because as soon as suppuration has ceased the double osteoplasty described later can be performed and the patient allowed to walk as soon as he could after being treated for a compound fracture say, six or eight weeks." A suggestion was made at that time that just as soon as suppura-

Fig. 3. Showing how completely the shaft of the tibia has been regenerated from periosteum alone.

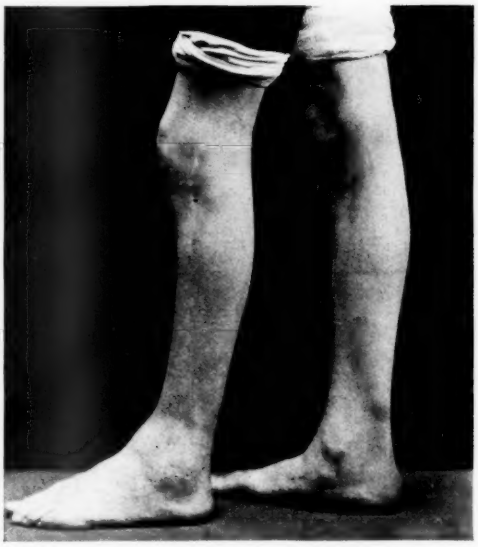


Fig. 4. Taken Feb. 11, 1910. Note the small amount of posterior curving in lateral view; also the small amount of outward curvature in front view as compared with the usual deformity, after extensive osteomyelitis of tibia.

tion was controlled, the lower end of the fibula be placed on the astragalus and arthrodesis performed on the upper tibiofibular articulation at the same sitting, because in this case, the upper end of the fibula was 1 cm. nearer the upper edge of the tibia than in the normal leg on account of the weight being thrown upon the ligaments about this joint. This amount of displacement occurred in one month's time in January, 1906, and he was confined to the bed for the first half of the month. There was also considerable increased motion in the left superior tibiofibular articulation. This made a difference of 3 cm. in the length of the two legs at that time and the difference on March 30, 1909, was the difference between 35.5 cm. and 32.7 cm., which is less than 3 cm., but this discrepancy may be accounted for by reason of the increased motion in the left superior tibiofibular joint on February 1, 1906, and the measurement was probably taken when the bone was displaced upwards as much as possible. On March 30, 1909, the distance between the top of the right fibula and top of the tibia was 2.5 cm., while the left was only 5 cm. less, viz., 2 cm.

It will be readily understood that inasmuch as the lower epiphyseal line of the left tibia was totally destroyed and if it contributes one-fourth to the growth in length of this bone that the fibula would encounter considerable resistance in forcing the new tibia without its lower epiphyseal line to contribute its part in the function of growth; to grow as fast as its fellow. The hope expressed in the first report seems to have been for the most part at least, realized at this time, March 30, 1909, a little over three

years and now nearly four, during which time the growth in the non-interfered with fibula has been 3.5 cm. in length, and if this continues until the patient attains his full growth, he will have avoided several severely crippling deformities, viz., much greater shortening, a talipes varus, and possibly one or both annoyances incident to the displacement upward of the upper end of the fibula, or the pain which accompanies the varus position where the fibula becomes part of the bearing surface of the sole of the normal foot.

At present the boy has a very useful leg, the tarsal joints have taken on sufficient increased mobility to counterbalance the loss of the normal ankle joint, and we all hope the fibula with its extra burden may prove equal to the task imposed upon it until growth has been completed.

If from the time of the operation until full maturity, the normal tibia increases from 7 to 10 cm., it can readily be imagined what a deformity the absence of the lower epiphyseal line would result in if the statement made by Doctor Cushing, that it contributes one-fourth of the growth, is true. In this case the shortening would already be between 8 and 9 mm., certainly sufficient to cause considerable deformity even with prompt regeneration of the tibia, which is shown by the radiographs taken soon after the operation and on March 30, 1909, the former by Doctor Haiselden, the latter by Doctor Max Reichmann, to both of whom the writer is much indebted for their courtesy.

From a rather complete review of the literature by Doctor Carl H. Von Klein,[1] to whom the writer is also much indebted, it seems fair to class this as a unique case, and the experience of the patient and writer has been most satisfactory, and it is believed that deformity of a crippling nature incident upon the increase in height, will be entirely obviated.

December 12, 1905: The measurement from the lower edge of the right patella to the tip of the external malleolus was 32 cm., whereas the corresponding measurement of the left leg was 30 cm.

On February 11, 1910, the corresponding measurements were 37 and 35 cm.

MISTAKES IN DIAGNOSIS RELATING TO THE URINARY TRACT IN FEMALES[2]

By J. CLARENCE WEBSTER, M. D., Chicago, Illinois

WHILE it is true that great progress has been made during the last fifteen years in the exact determination of diseased conditions of the urinary tract in the female, it is quite certain that in ordinary practice mistakes in diagnosis are of the commonest occurrence.

Cystitis, a localized inflammation of the bladder, is usually regarded as a disease which is easily diagnosed, its cardinal clinical features being frequency of urination, pain in the bladder, and the presence of pus in the urine. Among practicing physicians the diagnosis is very generally based on the existence of one or all of these features apart from accurate physical diagnosis, and herein is the cause of many errors.

I have recently had under my care a patient complaining of frequent and occasional painful micturition, the urine containing abundant pus. Her physician had irrigated the bladder every two or three days with a mild antiseptic solution, and had administered urotropin by the mouth. He reported that the bladder was tender when felt through the vagina. As the patient had previously been infected with gonorrhœa by her husband, the physician had believed that there was a late Neisserian infection of the bladder.

I made a cystoscopic examination of the bladder and found a normal mucosa. The right ureteral orifice was elevated and surrounded by a dull gray gelatinous looking

[1] Annals of Surgery.

[2] Read before the Chicago Gynecological Society, January, 1910. See discussion, p. 435.

area, a quarter of an inch in diameter. On vaginal examination only the right half of the base of the bladder was tender, due to the thickening of the ureter. Examination of the right lumbar region revealed an enlarged kidney, and the urine was found to contain tubercle bacilli. In this case all symptoms were related to the bladder, and the mistake in diagnosis led to serious delay in dealing with the renal tuberculosis.

In other renal conditions, e. g., calculus, new growth, non-tuberculous pyelitis, hydronephrosis, a similar error in diagnosis may occur because attention is concentrated on the bladder.

I have known a woman to be treated for cystitis on account of painful micturition when the real cause was early locomotor ataxia. A similar mistake has been made in the advanced stage of this disease, when beside the pain, frequency of micturition was present. Fortunately, however, tabes is rare in women and such a mistake can but rarely occur.

In general diseased states, e. g., gout and rheumatism, bladder distress and frequency or urination, due to irritating conditions of the urine, may wrongly be attributed to the presence of cystitis.

Not infrequently, neurotic women are treated for disease of the bladder when there is absolutely nothing wrong in this viscus. I remember a case which was treated for inflammation for a considerable period without effect. She visited various European health resorts but was not cured. On her return to England from the last one visited she was considerably shaken in a railway collision and never afterwards did she complain of her bladder trouble. Another patient, belonging to the idle rich class, having consulted various physicians, finally found one who told her that she had cystitis. She found great relief after vaginal examination was made and when the bladder was irrigated by the physician. When he insisted that the treatment be carried out by a nurse her troubles returned. This patient was later cured by hypnotic suggestion.

Frequently, cystitis may be diagnosed when only minor affections of the urethra exist, e. g., urethritis, fissure, caruncle, inflammation of Skene's tubules. The latter condition is very easily overlooked, and may be a cause of distress for a long period. The condition of the urine may even be misleading. Thus, pus may be found, which may come from a uterine, vaginal, vulvar or urethral discharge. Urine highly charged with phosphates, urates, or in a state of decomposition may be considered as purulent. Smegma bacilli may be mistaken for tubercle bacilli.

When there is a proteus infection of the bladder, the pus cells may be changed into a mucoid material and so overlooked.

Two interesting cases have recently come under my notice in which patients presenting the signs and symptoms of cystitis were treated for considerable periods with no benefit, because the real nature of the disease was overlooked.

In one of these, cystoscopic examination revealed a normal mucosa, but there was an opening in the bladder wall which communicated with an abscess cavity in the broad ligament. The latter had resulted from an infection following abortion. A cure was obtained by making a vesicovaginal fistula and enlarging the opening in the bladder-wall, drainage being kept up for about two months. The fistula was then closed.

In the other case, the patient had been treated for six months, the supposed cystitis following abdominal supravaginal hysterectomy. On making a cystoscopic examination an opening was found in the posterior wall of the bladder communicating with an abscess cavity in which a silk ligature was found encrusted with calcareous material. The latter was removed and the bladder was drained for several weeks by means of a vesicovaginal fistula which was afterwards closed, the patient recovering completely.

In each of these cases protracted ill health and distress resulted from failure to make an accurate diagnosis. This might have been avoided had cystoscopic examination been carried out early.

In various other pelvic affections in which bladder distress or frequency of urination is prominent, the actual diseased condition may be overlooked, e. g., uterine displacement, tumors, inflammatory swellings of the tubes and ovaries, adhesions, etc. I have seen several cases in which small fibroid tumors of the anterior wall of the uterus have caused dis-

tressing irritability of the bladder, leading to a diagnosis of cystitis.

Of great importance are the cases in which there is actual cystitis associated with some other condition which is of far greater importance.

I have operated on three cases of early carcinoma of the bladder in which the disease was not recognized until I had made a cystoscopic examination. In each instance cystitis alone had been diagnosed.

Very often tuberculosis of the urinary tract is allowed to develop unrecognized because cystitis is the most evident disturbance.

I have recently had under my care two cases of Neisserian infection treated for cystitis during many months, in which the cystoscope revealed extensive ulceration, which could be cured only be the establishment of a vesicovaginal fistula.

Ulceration of the bladder may also easily be overlooked, especially when there is only a small amount of pus in the urine. Last year I saw a case of this kind which had been examined by several physicians, whose verdict was that the patient had a bladder neurosis.

Vesical carcinoma may sometimes cause symptoms relating to the region of the rectum, thereby leading to a mistake in diagnosis. I know of one instance in which the coccyx was removed because of pain felt in it.

In various affections of the kidney and ureter errors in diagnosis are frequently made. Inflammation of the lower portion of the ureter is frequently overlooked.

Indeed, there is widespread ignorance of the anatomic relations of this structure, very few being aware that when the lower end is thickened and tender it may easily be palpated through the vagina and rectum. When the affection occurs on the right side it is often diagnosed as appendicitis or as inflammation of tube or ovary. Removal of the appendix has been frequently carried out as a result of this error.

In one month I saw in consultation four cases of pregnant women in which operation for appendicitis had been recommended, when only right-sided pyeloureteritis existed. In each of these cases vaginal examination revealed a tender right ureter.

The condition of moderate right-sided hydronephrosis, is a common cause of trouble in women, and, as Kelly has so emphatically pointed out, it is very widely overlooked. As it is usually associated with abnormal mobility in the kidney, the troubles produced by it are very often referred to the gall-bladder, stomach, appendix, or other structures.

Movable kidney is so frequently found without disturbance of health, that there is a tendency on the part of many physicians to disregard its importance to a very great extent. Yet clinical evidence abundantly shows that it may produce a variety of symptoms and signs which are very apt to be related to other organs.

Some of these only need be mentioned. Attacks of pain in the right upper quadrant of the abdomen, accompanied by nausea and vomiting, may be attributed to disease of the bile tract. When jaundice is produced, as is sometimes the case, the mistake is all the more easily made.

When the attacks of pain are referred to the region of the appendix, disease in the latter structure is easily suspected, and many operations for appendicitis have undoubtedly been carried out in such cases. Not at all infrequent are the cases in which the symptoms are those of gastric disease, leading to incorrect diagnosis and ineffective treatment.

On the other hand the cases are numerous in which various conditions may be wrongly diagnosed as movable or enlarged kidney, because of evidence obtained entirely by manual examination. Some of these are tumors of mesentery or omentum, pedunculated growths of the uterus or adnexa, distended gall-bladder or tongue-like downward extensions of the right lobe of the liver.

PERIGASTRIC ADHESIONS SIMULATING PYLORIC STENOSIS IN INFANTS

By C. G. GRULEE, A. M., M. D., and J. E. KELLEY, M. D., Chicago, Illinois

THE subject of pyloric stenosis in infants has of late years been the source of so much discussion that any fact which will add to the eludication of any points in its etiology or that of allied conditions will be of some importance not only to the pediatrician but also to the surgeon under whose care such a large proportion of these cases finally come.

Mrs. O. C., aged 18 years, entered Provident Hospital July 8, 1909, on the service of Dr. H. M. Stowe. Her last menstrual period was August 28, 1908, and there was no history of any unusual disturbance of health during pregnancy. No other children, and no history of abortion or miscarriage.

On the 10th of July, at 2: 25 A. M., she gave birth to a boy after a perfectly normal labor. The puerperium was normal in every respect and she left the hospital on July 22d.

The baby, a male, weighing at birth seven pounds, four ounces, was apparently normal in every respect. The eyes were treated with a ten per cent argyrol solution and the cord dressed with gauze moistened in alcohol. Two meconium stools. Temperature 100.6° to 100.8° F. Baby very cross.

July 11. Child very fretful. Three meconium stools. Slight hæmorrhage from cord which was redressed. Temperature 99.2° F. to 103° F.

July 12. Weight, six pounds, eight ounces. Child no longer fretful. Three small green stools. Temperature 103° to 104.2° F.

July 13.[1] Child had a restless night, did not cry, but did not sleep. Three large and four small liquid green stools, two containing mucus and one curds. Given barley water, three ounces, every four hours, since weighing the baby before and after nursing at breast showed no gain. Temperature 100.8° to 104.8° F. Sponging for temperature. Given sweet spirits of niter, three minims every three hours. Colonic flushing of normal salt solution. Had to be coaxed to take bottle.

July 14. One small green stool voluntarily and four with flushings. Temperature as high as 104° F., but responds readily to sponging, dropping to as low as 99° F. Weight, five pounds, fourteen ounces. No nourishment from breast. General treatment continued. Colonic flushing given with acetozone 1-6000 instead of normal salt solution.

July 15. Temperature rose to 104.6° F., but, as previously, responded readily to sponging. One cyanotic attack which did not immediately follow sponging. Weight, five pounds, eight ounces. Very little urine. Results of flushing same as on previous days. At 8 P. M. on this day the child vomited for the first time. General treatment the same.

July 16. Temperature dropped to normal and then as low as 96.2° F. During this day the child had repeated cyanotic attacks but did not vomit any more. Weight, five pounds, six ounces. Six very small green slimy stools. Previous to this for a few days the icterus neonatorum had been quite marked, but now began to fade. Flushings discontinued. Spts. nitrosi ætheris, m. iii every four hours. Brandy in water every four hours. Feeding by gavage.

July 17. Temperature ranged from 97.8° to 98.6° F. Baby seems better. Only one cyanotic attack. Three small green stools. One attack of contraction of muscles of hands and arms with twitchings about nose, eyes, and mouth. Weight five pounds, six ounces. Fed by gavage. Nitrosi ætheris discontinued. Brandy continued.

July 18. Temperature ranged from 97.4° to 99.4° F. One very small green stool. Fed by gavage. After 8 A. M. feeding vomited one ounce. After 12 noon feeding vomited a large amount. Retained 4 P. M. feeding, some of 8 o'clock feeding and most of the midnight feeding. Brandy continued.

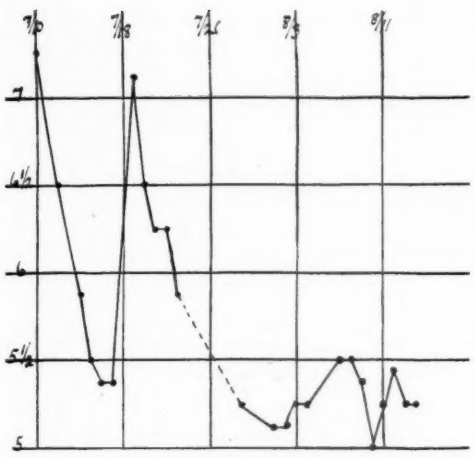
July 19. Temperature 97.8° to 98.6° F. Two small soft brown stools. Urination very small. Weight, seven pounds, two ounces. Severe cyanotic attack early in morning. Vomited all of 4 A. M. feeding as it did the other feedings during the day. Fed by gavage. Put to breast at 4 and 8 P. M. before being fed. Brandy discontinued.

July 20. Temperature 98.4° to 99° F. One small brown stool and one large brown salve-like stool. Weight, six pounds, eight ounces. Retained only one feeding. Still fed by gavage. Does not take breast well and gets nothing from it. Shows ulcers on each side at junction of hard and soft palate (Bednar's aphthæ) and also one in middle of the soft palate (probably a decubitus from passage of the stomach tube). Began to take nourishment from spoon.

July 21. Temperature 99.2° to 105.8° F. Weight, six pounds, four ounces. Four yellow or greenish yellow stools. Vomited feedings. Sponged for temperature, two colonic flushings of normal salt solution. Calomel, grs. 1-10 for four doses. Put to breast every four hours, but seemed to get nothing.

July 22. Temperature 97.4° to 103° F., but in general about normal. One large greenish yellow salve-like stool. Weight, six pounds, eight ounces. Continuous saline enema. Brandy in water every four hours. Rather extensive macular eruption on chest

[1] For feeding, see chart, p. 404.



Weight curve of Baby O'C.

and limbs which strongly resembled a scarlatinal rash but which had entirely disappeared in twenty-four hours. Blood, R. B. C., 7,800,000; W. B. C., 20,000.

July 23. Temperature 100.8° to 101.8° F. Weight, five pounds, fourteen ounces. Two small dark stools. Vomiting all of feeding although it was only barley water. Brandy discontinued.

July 24. Temperature 97.8° to 101° F. On examination of the stomach there were found to be distinct peristaltic waves passing towards the pylorus and forming a sort of pouch in the pyloric region, then relaxing when the peristaltic action was apparently at its height; at times the baby would gag as if nauseated but it never vomited. The peristaltic action of the colon was plainly to be seen and seemed to be directly influenced by that of the stomach but unfortunately the direction of the peristalsis in the colon was not noted. No tumor was palpable in the pyloric region.

The diagnosis of pyloric obstruction was made and immediate operation advised. The father refused to hear to this and removed the child from the hospital.

On the fifth day of life it was discovered that the cord was slightly infected. A probe could not be introduced into the umbilical vessels and in its course and appearance the infection was apparently a slight one.

The vomitus consisted usually of the milk ingested. As a rule this was brought up unchanged but sometimes there was some coagulation. However, at times, and especially as the vomiting became more severe, the presence of bile was not infrequent.

On July 25th, the day following its removal from the hospital, the father evidently became alarmed at the child's condition, since the child was returned to the hospital and consent for the operation was given.

July 25. When the child returned to the hospital the temperature was 103.8° F. That night it vomited even the water given it, but had one soft brown bowel movement. A continuous normal salt enema was given.

July 26. The temperature which at 4 A. M. was 98.6° F. had risen by noon to 105.6° F. Vomiting continued and vomitus was bile stained. Two stools, one large, soft and brown and one liquid and dark green. The peristaltic action of the stomach could be seen as above described. Normal salt enema continued. Colonic flushing given to reduce temperature, which fell under this treatment from 105.6° to 103° F. Strychnine sulph., grs. 1-1000 given once hypodermically. Infant was taken to the operating room at 10 P. M.

Operation. Report of Dr. Kelley. The abdomen was prepared for operation in the usual manner. Ether was used as an anæsthetic and administered by the drop method. When the cavity was exposed it was seen at once that there existed a condition of general and diffuse inflammation of the entire serous coat of all the intestines. The latter were seen to be deeply injected and in spots covered with a sort of tenacious white exudate, probably lymph. The transverse colon appeared prominently in the upper half of the abdomen and was markedly distended, almost to the size of the duodenum in an adult. There was a moderate degree of ptosis of the colon. The pylorus was searched for in an attempt to bring it into the field for inspection. This was not accomplished, due to the presence of rather firm adhesions in that region.

Two or three lap sponges were brought into use and the entire right upper quadrant of the abdomen was walled off by holding the main body of the intestine away with retractors. Inspection of this field revealed the following conditions:

The pylorus, upper portion of the duodenum and the hepatic flexure of the colon were rather firmly bound together by a roughly defined mass of adhesions, the result being to draw the pylorus and colon downward, though not a great distance. There was no evidence of concentric stricture or other occlusion within the pylorus. By gentle manipulation all the adhesions were freed and the pylorus slipped back into position. Simultaneously the colon collapsed.

The omentum, which had been held to one side during the operation was placed in position and a portion of it tucked in between the colon and pylorus at the point where the adhesions had existed, in the hope of preventing their re-formation.

A small amount of serous fluid which had been observed between the coils of intestine at the time of first opening the abdomen, was gently sponged away. It was not deemed necessary to drain the cavity. The abdominal wound was closed with through and through sutures of silkworm gut and a dry gauze dressing applied, after a collodion dressing was placed over the umbilicus, which had been infected from birth.

After return from the operating room strych. sulph., grs. 1-1000 was given hypodermically and the continuous normal salt enema was again started.

July 27. Temperature dropped to normal and did not rise above 101° F. Two soft brown stools. Vomiting continued, contained no bile but only some mucus. At times vomitus was curdy. Retained food ad-

ministered at 11 P. M. Normal salt enema discontinued. Strych. sulph., grs. 1-1000 given hypodermically every four hours.

July 28. Temperature ranged from 100.2° to 101.4° F., during the day, but rose to 104.2° F. at midnight. Did not vomit after 2 A. M. on this day. Two soft brown stools. Child much brighter and had a good night.

July 29. Temperature was 98.4° F. at 4 A. M., rising to 104.8° F. at 8 P. M. and dropping to 97° F. at midnight. No vomiting. One normal stool. Ice bag applied to head at intervals during the day. Infant fretful at intervals.

July 30. Condition unchanged except that temperature is much lower, even becoming markedly subnormal (96.4° F.). No vomiting.

July 31. Temperature 96° to 101° F. Otherwise condition same. No vomiting.

August 1. Condition same. Temperature not above 100° F. No vomiting.

August 2. Condition same. Temperature rose once to 99.4° F. Otherwise normal.

August 3. Temperature rose to 101° F. once. Otherwise no change.

August 4. Temperature rose as high as 102° F. Stitches removed by Dr. Kelley. Wound clean. Vomited once immediately after 8 A. M. feeding.

August 5. Temperature normal. Vomited once.

August 6. Temperature rose once to 100.6°. No vomiting.

August 7. Temperature tends higher, 99.8° to 100.8° F. No vomiting. Colonic flushing.

August 8. Child very cross. Temperature higher, up to 102° F. No vomiting.

August 9. Temperature not above 102° F., but more continuously high. No vomiting.

August 10. Temperature about the same. Vomited two ounces of 8 A. M. feeding. Two soft green slimy stools.

August 11. Child distinctly worse. Temperature up to 103.8° F. Vomited about a half ounce of the 9 P. M. feeding. Had to be fed with spoon.

August 12. Temperature at 4 A. M. 104.6° F., dropped to 100.2° F. at 4 P. M. No vomiting. Two greenish slimy stools.

August 13. Temperature down to almost normal, but child's condition much worse. Six soft brown stools, no slime. Given barley water, three ounces, every four hours, but vomited everything, even water. Infant sank rapidly and died at 11:25 P. M.

On the 11th the following clinical note was made: Child seems much worse. Forehead and cheeks corrugated with deep wrinkles. Cheeks relax at times but forehead never. Fingers flexed over thumbs, cannot be fully extended, especially marked on left side. Legs flexed on thighs and muscles so spastic that the legs will not remain extended. Trousseaus' and Chvosteks' signs absent.

Probe introduced into umbilicus penetrates about one inch downward along abdominal wall. No pus, no drop of blood. The contraction of the muscles relaxed quite perceptibly 24 hours before death.

Unhappily no autopsy was allowed.

FEEDING CHART OF BABY O'C

	July 12	July 13	July 14	July 16	July 19	July 22	July 24	August 1	August 3	August 8	August 10	August 12
Milk.....oz.	...	6	...	3	3	...	...	2	2	3	3	...
Skim milk.....oz.	...	...	7	4	3	...	10	8	8	4	4	...
Barley water.....oz.	15	...	...	...	...	15	...	...	10	8	8	...
Milk sugar.....oz.	...	½	...	...	½	...	...	½	½	½	½	...
Malt extract.....oz.	...	...	...	...	...	...	...	...	...	...	½	...
Saccharin.....gr.	½	...	...	...	...	½	...	...	...	...	...	½
Water.....oz.	...	9	9	8	6½	...	...	...	...	...	...	15
Number of feedings..	5	5	5	5	5	5	10	10	10	5	5	5
Amount.....oz.	3	3	3	3	2½	3	1	1	2	3	3	3
Intervals.....hrs.	4	4	4	4	4	4	2	2	2	4	4	4
Caloric value.....	45	186	77	107	156	45	110	160	190	167	207	45

The first thing to be considered in this case is as to whether the gastric adhesions were the cause of the first attack of severe vomiting. This can certainly be answered in the affirmative, since no vomiting occurred subsequent to twenty-eight hours after the operation. The vomiting immediately after the operation may, we think, be justly ascribed to the effect of the anæsthetic. It is impossible to say whether the adhesions re-formed, causing the second attack of vomiting or not, but it is at least permissible to consider this as very probable. That the vomiting was part of a general affection of the gastrointestinal tract is scarcely possible since with one or two exceptions the stools continued normal throughout the course of the disease and the vomiting bore no relation whatever to the nature or number of the stools.

To what were these adhesions due? Only two possibilities are to be considered: a general peritonitis following the infection of the cord, or a fœtal peritonitis. The sign of acute inflammation of the peritoneum at the time of operation (sixteen days after birth) were slight, we are justified in concluding that this condition existed before birth, especially since first vomiting occurred on the fifth day of life, too early for any adhesions to form from a septic peritonitis.

We have been able to find two similar cases in the literature, those of Mya (1) and of Czerny (2) and Peiser(3). That reported by Peiser was evidently not of a severe type because the adhesions were not divided until the child was five months old, and it was still living when nearly two years old. Peiser regarded this case as one of fœtal peritonitis.

Mya's case was in a girl baby fifty-two days old, in a state of extreme atrophy. The dis-

tended abdomen showed sausage-shaped tumors, that of the stomach showing a peristalsis from left to right and that of the transverse colon from right to left. Vomiting and stubborn constipation. At autopsy the stomach was hour glass in shape caused by strong adhesive bands and was tightly adherent to the transverse colon. The other internal organs showed nothing of interest.

The temperature curve is such a peculiar one that it would seem to deserve special attention. Almost immediately after birth the temperature rose above normal and continued so until the fifth day. It may be noted that the vomiting started on this day. This may have been the so-called "starvation fever" of the new-born which Czerny and Keller (4) believe to be due to an infection of the gastrointestinal tract. They also believe the umbilical infections in the new-born are secondary to an enteric infection, all of which would very readily explain the course of this fever for the first few days. It is to be noted that the baby took nourishment fairly well at least twenty-four hours before the temperature dropped, and that feeding by gavage was not resorted to until twenty-four hours after. The second rise in temperature followed an interval of five days in which the temperature was normal. This second rise of temperature was almost as marked as the first and was concomitant with severe vomiting. After the operation, the temperature remained high for five days, never, however, becoming completely normal. The whole picture resembles that of septicemia and although the cord symptoms were slight still it is hardly possible to regard this regularly remittent type of fever as a part of the clinical picture of the gastric adhesions. The cyanotic attacks may probably be explained as a symptom of the septicemia.

The weight curve is a peculiar one and the writers are absolutely at a loss to account for the wide variation in the first few days.

We have then, referable to the gastric adhesions, vomiting beginning on the fifth day of life, at first slight but gradually becoming very severe and occurring no matter what the food ingested might be. The vomiting occurred usually immediately after eating, but was sometimes delayed as long as a half hour. This vomiting was almost immediately relieved by division of the adhesions. The vomitus at first consisted of unchanged milk, or at times curdled, but later it was bile stained, a condition very infrequently encountered in true pyloric stenosis in the infant (5). The peristaltic waves differed in no way from those of pyloric stenosis, but the involvement of the colon in this action was so suggestive that Dr. Kelley suspected adhesions to be present.

As to what bearing this case may have on the question of pyloric obstruction in infants (6) the nature of which disease is so much discussed at present it would be hard to say. This much at least may be concluded — that increased peristalsis may be primarily due to obstruction at the pyloric orifice and that the removal of this obstruction may result in the disappearance of these peristaltic waves.

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ACUTE DIFFUSE SUPPURATIVE PERITONITIS FROM A RUPTURED PUS TUBE[1]

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PERHAPS to many gynecologists, who for a considerable number of years have been assisting to definitely decide upon the proper treatment of suppurative infections of the uterine appendages in women, the title of this contribution may recall memories. But the condition of a patient who, from a ruptured pyosalpinx, has a general suppurative peritonitis rapidly becoming fatal, is one that does occasionally occur and its gravity demands rare surgical judgment and skill. It is quite probable that when the purulent contents of a Fallopian tube have become sterile, rupture of that structure with escape of its contents into the peritoneal cavity may occur with little or no harm to the individual of which it is a part. Not uncommonly are the fimbriated ends of such tubes fround permeable and without macroscopical appearances of inflammation in their vicinity, though pus may be coaxed or kneaded from the lumen of them. Again, localized peritonitis about suppurating tubes is quite the usual condition noticed. It is to another and very different condition I would invite attention, which is, Fallopian tubes distended to a considerable degree by infected fluids to which is added the phenomena of sudden and notable rupture of the tube with escape of the contents into the general peritoneal cavity.

An experience of this character has been mine and I will detail it as follows:

During the early morning of May 7, 1909, I saw, in consultation with Dr. Ramsburg, a woman 38 years of age who apparently weighed about two hundred and thirty pounds. Dr. Ramsburg stated he had attended the patient professionally for a few years and had delivered her of her third baby in January, 1909. During coitus early in the morning of May 4th, she had experienced very severe pain in the right iliac region. He saw her promptly and at 6:45 A. M. found her in some pain, but a pulse rate of 76 and temperature of 98.4° he noted in his minutes. By enemata her bowels were freely moved and at 11:30 A. M. the temperature was 103.6° and the pulse rate 120. The following morning (9:30 A. M.) the temperature was 100.6° and the pulse 84. During the night the bowels had moved six times. About 4 P. M. temperature was 101.2° and pulse 106. The following day the temperature ranged from 101.6° in the morning to 103.2° at 8 P. M. Her condition was little changed. The pulse reached 120 that evening. At my first visit we found her temperature was 101.6° and the pulse 100. She was complaining of having a severe pain in the right inguinal region. A quite careful examination failed to find an unusual mass at any place and on bimanual examination I could find no evidence of a pathologic appendage. To place her in a hospital for careful observation, and possibly operation, seemed advisable and she was at 10:30 A. M. admitted to Columbia Hospital for Women. At 4 P. M. her temperature was elevated to 102.4° while the pulse remained at 88. A leucocyte count was made and a report of 23,100 returned. She seemed brighter and operation was deferred, yet considerable gaseous distension of the intestine was troubling her. On the 8th she was progressing toward recovery, apparently, when late in the afternoon, after freedom from pain since morning, the temperature at noon being 101° and the pulse 84 to 90, she was again attacked by pain, now very violent, in the right inguinal region with a chill followed promptly by collapse. The abdomen rapidly increased in tension and in the evening an operation was done. An incision was made a little to the right of the right linea semilunaris, its upper end being opposite the umbilicus. When the peritoneum was incised a considerable quantity of thin seropurulent material poured out through the opening. The cæcum and vermiform appendix were found much nearer the diaphragm than they are usually placed and macroscopically normal. The right Fallopian tube was from one to one and a half inches in diameter and ruptured. It was exceedingly friable and removed in pieces, the stump being whipped over by catgut. Several intestinal loops were adherent to this tube but easily separated. The pelvis was lightly packed with gauze, one end of which was carried through vagina and vulva. At the end of the operation her temperature was 99.2° and pulse 120. At noon the day after operation the temperature, rising gradually, had reached 103.4°, but twelve hours later had dropped to 101.8°, and the pulse to 100. The drop method of instilling salt solution into the rectum had been employed faithfully since her admission to the hospital. The bowels were at noon moved well with a purgative enema. On the 10th the condition

[1] Read at the Twenty-second Annual Meeting of The Southern Surgical and Gynecological Association at Hot Springs, Virginia, December 14, 15, and 16, 1909.

was worse; vomiting was an additional symptom and the end seemed near. It came at 3 A. M., the 11th, nearly seven days after the first severe pain and about 54 hours after the operation.

That the condition is a rare one is suggested by the small number of cases reported, that the largest number reported from the experience of one man is six (Boldt) and that several have reported one or two. Bonney states he wrote fifty surgeons asking for reports of their experience with such cases. Of the forty who replied but fourteen had seen the condition. He received in this way notes on fourteen cases. In a moderately careful review of medical literature I have found fifty-five cases, which added to the one I herein report makes a total of fifty-six cases. It is quite probable a careful perusal of all reports and tables of series of surgical treatment of pyosalpinx and of acute peritonitis would disclose a few more. But I think the infrequency of the condition must be apparent. The gravity of such a calamity is shown in the high mortality attending it, thirty-two (58 per cent) having died, either with or without operation. In one (Anderson's) the result was not given and the case was reported the day of the operation.

Etiology. An inquiry into the causes of pyosalpinx rupture into the peritoneal cavity with resulting acute peritonitis carries with it the presumption that the infecting organism in the tube was permitted to pass through the rupture in sufficient strength to immediately involve the whole peritoneal surfaces in the same process as existed in the tube. The larger part of tubal infections producing suppuration is caused by the gonococcus. Yet in no instance in this series of cases was that organism found in the abdominal contents. In but a few were bacteriological reports made. Frank found the staphylococcus pyogenes aureus, and the colon bacillus was recognized by another. I will not here enter into a discussion of the various pathogenic organisms that produce suppuration of the Fallopian tube. We are informed by some careful observers that the gonococcus is not capable of extensively injuring the peritoneum and, *per contra*, others insist peritonitis of a fatal character may be produced by this organism unassisted. But those of us accustomed to treat extensively tubal infections and to await an innocuous state of the pus before operation are impressed by the very large proportion in which but a few days or weeks are required for that state to be reached. In these the gonococcus is probably acting alone. But can all these temporarily quiescent cases be thus produced? If so can the gonorrhœal tube contents be suddenly aroused to fury when allowed in liberal quantities to reach the peritoneum, or is the infection of the tube of a mixed character, all the varieties remaining quiescent until rupture occurs, a period of months in some of the cases reported? In most cases violence of some sort was reported. Perhaps it was not more than transportation to a hospital for treatment for pelvic inflammation (Ingalls, Vance, Mann) and during the following day or two acute and striking symptoms would ensue, ofttimes, the patient had not been out of bed for several days just preceding the rupture. In several instances the traumatic element was childbirth. In this respect, the experience of Oleson, of the Cook County Hospital, Chicago, was unique. He had at one time two cases in which this accident caused death in the puerperium. In one the labor at eight months was rapid and death occurred five days later. In the other the labor was of so short duration that he had not time to get into the ward before the birth and she also died in five days (see table). A few quickly followed currettage and Legueu reports two that were noticed as soon as the accident occurred, which was during a bimanual examination of the pelvic contents. Two occurred during coitus and another was probably a direct result of the woman lifting a heavy child.

Symptomatology. In the cases that ruptured during labor the symptoms of this grave accident were clouded by those of labor, and in them usually an autopsy revealed the first knowledge of the real pathology. Fabricius' case is a bold exception and the only one that recovered. In the others, the symptoms are quite like those of ruptured tubal pregnancy or tubal abortion. Usually, however, the patient is ill with pelvic inflammation but perhaps does not remain in bed. While at her duties, after recovery from an attack of infection of the uterine appendages, or resting

TABLE OF CASES OF ACUTE GENERAL PERITONITIS FROM RUPTURE OF PYOSALPINX

Reported by	Duration or stage of peritonitis.	Notes.	Result.
1. Chipault, Bull. Soc. Anat. de Par., 1861, xxxvi, 149	Acute, general	No operation. Autopsy findings: Right tube distended with pus, left tube contained some pus and had a small rupture; cancer of uterine cervix was advanced	Death.
2. MacLaren (see Bonney)	Acute, general	Second day of attack, incision, with flushing and drainage. Autopsy findings: A ruptured, distended pus tube and general peritonitis	Death 2 days after operation.
3. Almagro, Bull. Soc. Anat. de Par., 1862, xxxvii, 171	Acute, general	No operation. Autopsy findings: Pus in abdominal cavity, right tube enormously distended by pus and has a rupture 4 cm. long; left tube also distended but not ruptured	Death 2d day in hospital.
4. Rochet, J: d'accouch., 1892, xiii, 195	Acute and general	Five days after admission to hospital abdominal and vaginal sections were made, drainage employed. Autopsy findings: General purulent peritonitis, with tubes enlarged and the right ruptured and containing pus	Death promptly followed.
5 C. S. Wood, Tr. N. Y. Med. Assoc., 1890, vi, 49	Acute, general	Operation during the first 24 hours by W. Gill Wylie, during collapse, abdominal section, right pyosalpinx had ruptured	Recovery.
6. E. G. Janeway, N. Y. Med. J., 1880, xxxii, 522	Admission on 14th day of attack	No operation. Autopsy findings: General peritonitis, patches of fibrinous lymph on liver, intestine, and uterus, 12 ounces of pus in pelvis, right pus tube ruptured, left pyosalpinx unruptured	Death 4 days after admission.
7. Spehl (reported by Wicot) Clinique, Brux., 1893, vii, 529	Ill with the attack of pelvic peritonitis 14 days before admission	No operation. Autopsy findings: Pus pocket in inferior right lobe of lung, pus very abundant in peritoneal cavity; intestinal loops covered by fibrinous, thick, and very adherent exudate, circular rupture in left tube 2 cm. in diameter	Died 12 days after admission to hospital.
8 and 9. Legueu, compt-rend, Soc.d'obst..de gynec. et de paed-de Par., 1903, v, 83	Both acute	Operation was done at once. Both were ruptured by examination and abdominal section 1½ hours later in one, and 1 hour in the other, ruptured tube found in each	Both recovered.
10. Peuch, compt-rend, Soc. de biol., Paris, 1860, 3d s., i, 27	Subacute	No operation. Autopsy findings: Cystic left ovary; inflammation and abscess of both tubes, one ruptured and abdominal cavity deluged	Died 3⅓ months after admission to hospital.
11. Cerné, Bull. Soc. Anat. de Par., 1880, xiii, 37	Seized 3 days before admission	Autopsy findings: Ruptured left tube and general acute peritonitis, intestinal coils adherent	Died 3 days after admission.
12. Proust and Mascarenhas, Bull. et mem. Soc. Anat. de Par., 1909, lxxxiv, 294	Admitted on 6th day of attack	Operated upon at once upon admission. Large quantity of fetid, purulent fluid escaped from the abdominal incision, rupture found in lower posterior surface of the right pus tube, the latter removed, left tube normal, drainage	Recovery.
13. Fabricius, Wien. Klin. Woch., 1897, x, 1056	Acute, ruptured during labor	Prompt operation with removal of the ruptured tube	Recovery.
14. Boldt, Am. J. Obst., 1889, xxii, 262	Acute, general	Operation done on the 6th day, pus found in peritoneal cavity' intestines matted together; both tubes ruptured	Death in 60 hours.
15. Boldt, ibid.	Acute, general	On second day abdomen was opened and right tube found ruptured	Died.
16. Boldt, ibid.	Acute	Operation a few hours after rupture of right tube, perforation 2 cm. in diameter, free fluid in peritoneal cavity and the peritoneum considerably congested	Recovery.
17. Boldt, ibid.	Three days' duration	Operation refused. Autopsy findings: Peritoneal cavity full of pus, intestines matted, double pyosalpinx, the right ruptured	Died.
18. Boldt, ibid.	Acute	Operated upon 3 hours after onset and in collapse, free fluid in the peritoneal cavity and the left pus tube ruptured	Recovery.
19. Boldt, ibid.	Acute	Operation deferred too long because of apparent improvement, operation was not done at all. No autopsy	Death in 36 hours.
20 and 21. H. Brin, Arch. méd. d'Angers, 1900, iv, 556	Both acute	Autopsies disclosed ruptured pus tubes and acute, general peritonitis	Both died.
22. Cotte and Chalier, Rev. de gyn. et de chir. abd., 1907, xi, 579	Admitted 2 days after beginning of attack of acute perforative peritonitis	Operation a few hours after admission. Peritoneal cavity found full of sero-purulent fluid, intestines not adherent. Nothing but insertion of drainage tube into pelvis was done. Autopsy, perforation in a right pyosalpinx large enough to admit little finger	Died 40 hours after operation.
23. Cotte and Chalier, ibid.	Acute, general, of two days' duration	Operation day of admission, free fluid in peritoneal cavity and pus in pelvis. Left pyosalpinx found ruptured, collapsed and nearly empty, perforation in middle of a gangrenous area near ampulla, appendage removed and drainage through abdomen and vagina	Death 3 days after operation.
24. Cotte and Chalier, ibid.	Advanced, general	No history obtainable, condition very grave, precluding operation. Autopsy showed rupture of right pyosalpinx	Death a few hours after admission.

TABLE OF CASES OF ACUTE GENERAL PERITONITIS FROM RUPTURE OF PYOSALPINX—Continued

Reported by	Duration or stage of peritonitis.	Notes.	Result.
25. Cotte and Chalier, ibid.	Admitted 6th day of attack of general peritonitis	Operation a few hours after admission, free fluid in peritoneal cavity and pus in pelvis; perforation ½ cm. long found in anterior surface of a right pyosalpinx, tube not removed, abdominal and vaginal drainage, condition precarious, repeated operations during the following three months ended the condition	Recovery.
26. Cotte and Chalier, ibid.	Admitted 3d day of attack of general peritonitis	Operation one hour after admission; large quantity purulent fluid in peritoneal cavity. Two perforations found in large right tubo-ovarian abscess, one as large as a franc piece	Died 24 hours after operation.
27. Bullitt, Louisville J. of Med. and Surg., 1900-1, vii, 471	Acute, general	Admitted for operation for chronic salpingitis and pelvic peritonitis — no urgent symptoms though abdomen distended and painful — operation deferred, suddenly became worse; died 48 hours after admission. Autopsy revealed general peritonitis and a large perforation in a left pyosalpinx	Death.
28. Cartledge, Louisville J. of M. and S., 1900-1, vii, 472	Acute, general	Moribund when first seen, perforation of left tubo found as cause of peritonitis at operation	Death.
29. Vance, Louisville J. of M. and S., ibid.	Acute	Admitted to hospital for minor gynecological treatment, next day suddenly became shocked and abdomen opened in three hours. A ruptured pus tube was found	Recovery.
30. Abell, ibid., 1906–7, xiii, 403	Acute	Operation third day of illness, a ruptured right pyosalpinx found	Recovery.
31. Anderson, ibid., 153	Acute	Operation and both tubes contained pus and ruptured and general peritonitis, patient was living at time of report which was made on day of operation	Not known.
32. Leith, African Med. Rec., Cape Town, 1907, v, 230	Acute, general	Operation first day of attack, parietal peritoneum, thickened and congested and lymph on intestines, left pyosalpinx ruptured	Recovery.
33. Young, Boston M. and S. J., 1905, clii, 551	Acute, general	Admitted 3d day of attack of pelvic suppurativei nflammation. The following day had excruciating abdominal pain, vomiting, collapse, and rapidly developing peritonitis. Operation without delay, pus found in all parts of peritoneal cavity, a ruptured pyosalpinx was found and exsected	Recovery.
34. Fenwick, Lancet, Lond., 1897, ii, 1385	General, suppurative	Died two days after admission and without operation. Autopsy showed general suppurative peritonitis, evidence of old pelvic inflammation, and a ruptured pus tube discovered	Death.
35. Oleson, Chicago Med. Rec., 1894, vi, 324	Acute, general, suppurative	Died 5 days after labor at which pus tube probably ruptured. Autopsy showed a pus tube ruptured near fimbriated end and general acute suppurative peritonitis, rapid labor at eight months	Death.
36. Oleson, ibid.	Same as in 35	Rapid and sudden delivery before arrival of obstetrician in ward; 2 days later chill and T. 103.2°; died 5 days after labor. Autopsy findings the same as in case 35	Death.
37. M. Price, Am. J. Obst., 1889, xxii, 925	Acute, suppurative and general	Operation 15 days after apparent rupture of a pyosalpinx in a case of incomplete abortion; both tubes had ruptured	Death.
38. Louis Frank, Med. News, Phila., 1895, lxvi, 609	General, acute, suppurative peritonitis	Admitted to hospital in midst of an attack and next morning was in collapse, laparatomy a few hours later, the patient died in 9 hours. Autopsy revealed rupture of a right tubo-ovarian abscess	Death.
39. Mann, Am. J. Obst., 1907, lvi, 461	Acute, general	Patient in hospital for pelvic suppuration. Sudden onset of alarming symptoms on 2d evening after; next morning operation showed right pus tube ruptured an inch from fimbriæ and general peritonitis.	Recovery.
40. Mann, ibid.	Acute, suppurative, general	Two days after an examination by a physician, who diagnosed tubo-ovarian abscess, was suddenly attacked by illness and collapse promptly ensued. Operation done at once, a large tubo-ovarian abscess, ruptured, was found, the opening being the size of a ten cent piece	Recovery.
41. Cushing (see Bonney) Surg., Gyn. and Obst., 1909, ix, 542	Acute, suppurative	Operation day of rupture of a tubo-ovarian abscess into peritoneal cavity	Death.
42. Dudley (see Bonney)	Acute, suppurative	Operation a few hours after rupture of a pyosalpinx into the peritoneal cavity, complicated by rupture of vermiform appendix	Recovery.
43. Findley (see Bonney)	Acute, general, suppurative	Induced criminal abortion followed in three weeks by curettage for infection of uterus and appendages; 3 days later evidence of general peritonitis; operation refused and death 4 days later. Autopsy, double pus tubes; the left contained a large perforation causing diffuse suppurative peritonitis	Death.
44 and 45. Gardner (see Bonney)	Acute, general, suppurative	Two cases practically alike. Both admitted during attack. Operation both tubes found to be enormously distended with pus and one had ruptured contents free in peritoneal cavity. Neither had acute fulminating peritonitis	Recovery in both cases.

TABLE OF CASES OF ACUTE GENERAL PERITONITIS FROM RUPTURE OF PYOSALPINX—Continued

Reported by	Duration or stage of peritonitis.	Notes.	Result.
46. Ingalls (see Bonney)	Acute, suppurative	Patient in hospital and treated for acute salpingitis. Late one afternoon found in collapse; abdominal distension rapidly followed. Operation in a few hours. A ruptured pyosalpinx removed, abdominal drainage	Recovery.
47. Ingalls (see Bonney)	Acute, suppurative	Admitted to hospital 6 hours after rupture and 3 hours later operation. General peritonitis and a ruptured pyosalpinx removed. Vaginal and abdominal drainage, fever continued	Death in 3 months.
48. MacMonagle (see Bonney)	Acute, septic	Patient apparently ruptured pus tube in labor and had acute septic peritonitis, dying on the 4th day. Autopsy, left tube had ruptured and discharged pus into peritoneal cavity	Death.
49. MacMonagle (see Bonney)	Acute, general, suppurative	Young woman on whom an abortion had been attempted, acute peritonitis followed. Operation immediate, when first seen and right tube found ruptured	Recovery.
50. Smith (see Bonney)	Acute, suppurative	Patient seen one hour after rupture, operated on at once, pyosalpinx had ruptured in the middle and deluged peritoneal cavity	Recovery.
51 and 52. Webster (see Bonney)	Acute, fulminating	In both a pyosalpinx had ruptured into the general peritoneal cavity and gave rise to an acute fulminating peritonitis. Both made stormy recoveries. Operation done during first few hours	Both recovered.
53. C. W. Bonney, Surg., Gyn. and Obst., 1909, ix, 542	Acute	Suppurative inflammation of the appendages had probably existed 3 weeks before very alarming abdominal symptoms and apparent imminent death induced her removal to hospital at night and operation, 5 hours after first alarming symptoms an abundant outflow of sero-purulent fluid from abdomen, intestines injected and distended, a partly collapsed right, large pus tube was found perforated. Appendage removed, peritoneal cavity flushed out, abdominal drainage	Recovery.
54. A. Theilhaber, Muench. Med. Woch., 1905, lii, 69: 122		This author in an article of six pages on "The pathology and therapy of chronic salpingitis" merely mentions a case in which perforation was followed by an unsuccessful operation	Death.
55. A. Mary, Sur un cas de rupture de pyosalpinx pendant l'accouchement, Thés. de Par., 1908	Acute	A girl of 16 years, died six days after labor. Temperature was never normal afterwards. Two day post-partum curettage was done as the pulse was 125 and T. 102.4°. Autopsy revealed general peritonitis and a large right pyosalpinx rupture midway in the length of the tube	Death.
56. Author's	Acute, diffuse	Severe pain through iliac region during coitus, under observation by me from early in 4th day, symptoms of rupture on fifth day of illness, operation done a few hours later. Tube had ruptured and inundated the peritoneum with pus	Death 3d day after.

comfortably in bed, perhaps in a hospital preparatory to surgical operation, she suddenly experiences excruciating localized pain, perhaps a chill and collapse. Fever and high thready pulse promptly follows, if death does not soon supervene, and distension of the abdomen together with the general symptoms of diffuse peritonitis are not long delayed. Sometimes the surgeon being familiar with the pelvic contents before rupture has readily discovered after it that the tube was collapsed and flaccid instead of full and tense as before rupture.

Diagnosis. When rupture occurs during labor the accoucheur should discover a considerable softening in a mass existing at the side of the uterus before labor, and symptoms of peritonitis appear so promptly that they should be readily recognized. The cause of the peritonitis would then have to be learned by a process of exclusion and a knowledge of of the ante-partum symptoms and tubal conditions will markedly assist in reaching a correct diagnosis. In non-puerperal cases the previous history of pelvic infection accompanied by suppuration, the absence of evidence of pregnancy, especially tubal, together with the rapid appearance of the symptoms of diffuse peritonitis, should be sufficient for a diagnosis. When the right tube has thus ruptured it has been mistaken for fulminating appendicitis. The previous history will be an important element in making differentiation. In those cases in which the vermiform appendix is simultaneously markedly involved the differentiation or possibility of diagnosing both conditions is not always present.

Prognosis. What can be said of the pros-

pect of recovery? It requires no comment when the death rate in all cases is fifty-eight per cent and one hundred per cent without operation. Much depends upon whether a previous severe attack of pelvic infection has left the patient with little or much resistance; whether the total of virulence of the invading tubal contents be great or slight, the general condition of the patient independent of these features; and the form of treatment instituted. At the best these patients must be considered as in a critical condition, and whatever the plan of surgical treatment employed, it must be instituted with the least possible delay.

Treatment. All of the eighteen that were not operated upon died. The time they lived after rupture varied from a few hours to three and a half months. Two patients admitted to hospitals on the fourteenth day after rupture lived respectively four and twelve days. Of the 12 others that died without operation of which data is obtainable the average number of hours they lived was fifty-nine.

Thirty-eight were operated upon and fourteen of them died — a mortality rate of 37 per cent. One of this series (Ingalls) lingered along for three months in the hospital and yet her operation was but nine hours after rupture. But three of the post-operative fatalities were in patients operated on during the first twenty-four hours after rupture. The other deaths had preceded the operation by from two to fifteen days. One operation was done during the first few hours (Anderson) and reported the same day without the result being mentioned. Of the twenty-three in which successful operations were done, in twenty it was performed during the first twenty-four hours. Such expressions as "immediately," "at once," and "few hours" are used in the reports of them. The other three successful operations were done, one on the third and two on the sixth day. Twenty-five of the operations were done during the first twenty-four hours. In one of these no result was given. In the other twenty-four operations five were unsuccessful. One of the five deaths occurred in nine hours, one in fifty-four hours, and one in three months. The three patients operated on during the second day all died. Of three operated on the third day one recovered. Of the seven operated on more than three days after rupture had occurred four died. We find the mortality rate, then, for operations during the first day after rupture was (excluding Anderson's case) nearly 21 per cent; for those done during the second day, 100 per cent; for those done during the third day, 67 per cent, and for those done after the third day, 57 per cent. It would seem, then, that if possible all cases should be operated upon, since in all of the eighteen reported in which no operation was done death resulted. The comparatively small mortality rate of the first-day operations would seem to demonstrate the decided urgency of operating the first day and without delay. While but one of the six operations done on the second and third days was successful, three of the seven done at more remote periods were successful, and we should be encouraged to operate even if considerable time has elapsed since rupture, although moribund patients do not present a hopeful spectacle to the abdominal surgeon. The late lamented Cartledge states in the report of his fatal case of this kind that enthusiasm and ignorance of early experience led him to operate, but that greater experience and better judgment would form an opposite decision.

DEPARTMENT OF TECHNIQUE

CONCERNING SUPRAPUBIC PROSTATECTOMY[1]

By L. L. McARTHUR, M. D., Chicago, Illinois

I DESIRE to preface my communication with the statement that I am an advocate of both the suprapubic and the perineal routes; suiting the operation to the case in question.

Permit me after a personal experience covering a considerable period, but not a large series of cases, to invite your attention to a procedure when doing a suprapubic prostatectomy, worthy of our higher esteem and more frequent employment.

You will recall that the customary and recognized step after the fundus of the bladder has been opened is in one of various ways to perforate the bladder mucosa to one or both sides of the internal meatus, or behind the latter. Through these openings made at the discretion of the operator, either with the knife, scissors, or the finger, the lobes of the prostate are loosened and enucleated by a blunt dissection with the fingers. In this enucleation, I believe all of us are free to admit that a great portion of the prostatic mucosa is at the same time torn and removed. Since this is the case can we do anything to lessen the trauma attendant on the above procedure? It is in the belief that an affirmative answer to the above question is justified that I venture to recall to your attention what has failed of general adoption, though long known.

It is this: There is no need (nor excuse?) for the wounds made through the bladder wall to gain access to the prostatic lobes. Proof of this, if needed, could be found in the modern median perineal prostatectomy which makes just sufficient perineal wound to permit the index finger free access to the prostatic urethra. With the finger thus introduced into the urethra the lobes are more or less readily removed. If, from without, one can so readily remove the lobes by a lateral tear in the prostatic urethral mucosa one can by identically the same procedure remove them by the introduction of the finger into the prostatic urethra through the *internal* meatus. The difference being that the finger is directed toward the apex of the gland instead of toward its base.

The points I desire to emphasize then are:

1. It is quite unnecessary in most cases to make any wound in the bladder mucosa or wall in the neighborhood of the internal meatus.

2. When making the lateral tears in the prostatic urethral mucosa do so for both lobes before doing any enucleation, taking pains to make these tears in the long axis of the urethra and endeavoring on both sides to loosen their margins from the prostatic lobes, before any step whatever is made to loosening of prostatic lobes from their capsules.

3. In all those prostatic hypertrophies bulging into the bladder as an enlarged uterus does into the vagina, there is scarcely more than mucosa covering the prostatic tissue, hence after enucleation through the internal meatus, the internal sphincter, that whorl of vesical muscular fibres situated in the bladder substance itself, has not been disturbed, or at most distended, while perforation of the bladder wall near the meatus may easily injure the sphincter fibres or paralyze them. Moreover, when the prostatic bodies which constituted the projection into the bladder have been removed, the mucosa covering the same, lacking its former support, now drops into the internal meatus and covers part at least of the denuded prostatic urethra.

4. The bladder trigone being drained by an efficient syphon and having made no wounds within the bladder, urine has little opportunity to stagnate over denuded surfaces.

[1] Read before the Chicago Surgical Society, February, 1910. See discussion, p. 437.

RAFFIA RIBBONS AS DRAINAGE MATERIAL.

By SAMUEL E. NEWMAN, M. D., St. Louis, Missouri

OUR knowledge of the mechanical and the physiological principles of drainage has increased. Wounds are closed which we formerly drained, and small well-placed drains have supplanted the less carefully applied large crude forms.

1. When a hollow viscus or a cavity is to be drained, frequently a hard or soft tube is employed; i. e., *tissue intubation*.

2. If our aim is to establish an outlet for wound secretion or the eventual accumulation of serum and pus, we select material to aid in the formation of a channel; i. e., *tissue canalization*. To this end a capillary or a non-capillary material may be chosen.

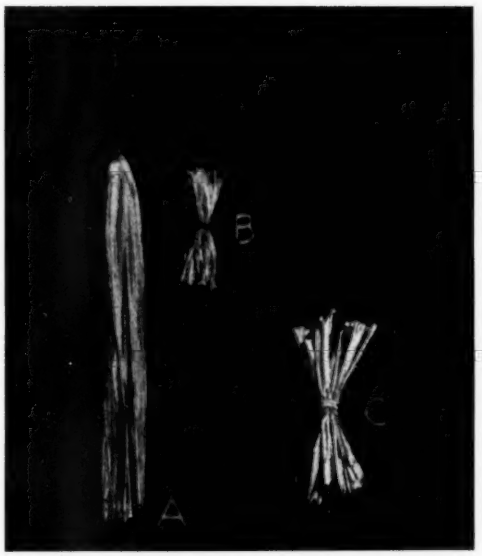
3. In *tissue walling* the main object is temporary protection for the structures and the formation of a defense barrier.

4. When hæmostasis of the tissues is the end in view, *tissue packing* is employed.

Under these captions we have four entirely distinct varieties of drainage, and it is to the subject of *tissue canalization* that I wish to add a material called *raffia*. *Raffia* is a vegetable fibre and is obtained from a variety of palm tree indigenous to Madagascar Island. To quote an article on the subject, "The under part of the green palm leaf is of a pale greenish color, and from that side the skin can be peeled off in the same manner as the skin on the inside of a pea-pod, except that it peels off straight to the tip without breaking. It is then of the palest green, and after being dried in the sun assumes a light straw color. This is the raffia of commerce." In our country this material is employed in basketry and florists use it as cordage. It is obtained in large twisted skeins, each skein containing a great many ribbons of from three to four foot lengths.

PROPERTIES OF RAFFIA

When dry it is a pliable cord easily split in a lengthwise direction, but possessed of unusual strength and does not break. When wet, raffia is as soft as wet paper and tends to spread out in ribbons of from one-half to one inch in width. It does not deteriorate at the temperature of boiling water, nor is it injuriously affected by watery or antiseptic solutions. Capillarity is one of its qualities and the strands rapidly absorb water. The capillarity of raffia is however not as marked as that of gauze, and where this feature is of importance, all things being equal, the gauze should take preference.



USING THE RAFFIA

The material may be boiled at the same time with the instruments, or it may be preserved ready for use, in an antiseptic solution. Drains which have not been used are not wasted and may be resterilized. Fig. B represents a folded bundle of raffia in convenient form, and Fig. A is the unfolded bundle of ribbons. Several fascicules may be placed in a wound and the individual bundles removed on different days, or when a single bundle is employed in a small wound, the individual ribbons may easily be withdrawn. In Fig. C a sheaf of ribbons for minor surgery is shown; one or more of the strands may be employed as a drain and the remainder is again replaced into the antiseptic solution.

As far as my observations can determine, raffia possesses no objectionable features. The ribbons are perfectly bland and remain in the tissues unaffected by secretions. There is no danger of a decubitus from contact and healthy granulations grow around and not into the fibre.

The inexpensiveness of this material is of practical importance.

REMOVAL OF TUMORS OF THE PITUITARY BODY

With a Suggestion as to a Two-step Route, and a Report of a Case with a Malignant Tumor Operated upon with Primary Recovery

By ALLEN B. KANAVEL, M. D.
Professor of Surgery, Post-Graduate Medical School; Assistant Professor of Surgery, Northwestern University Medical School

AND

JULIUS GRINKER, M. D.
Professor of Nervous and Mental Diseases, Post-Graduate Medical School; Assistant Professor of Nervous and Mental Diseases, Northwestern University Medical School, Chicago, Illinois

SURGICAL DISCUSSION (Kanavel)

THE successful removal of tumors of the pituitary gland is still uncommon in spite of the attention the subject has received. In the Journal of the American Medical Association of November 20, 1909, I reported a proposed operation for the removal of these tumors. I had removed such a tumor a week previously from the patient whose history is herewith attached, but it was too late to include the report in that article. The patient came under my observation in the early part of June and was the direct cause of the cadaver work which led up to the operation I proposed in the article to which I have referred. The patient, however, refused operation at that time and returned only when his symptoms became unbearable. I am greatly indebted to Dr. R. S. Patillo, Dr. A. A. Goldsmith and Dr. Julius Grinker who referred the case to me. Dr. Patillo made repeated observations upon the eyes and his report with that of Dr. Grinker will be found attached.

The practical experience gained in this case, serves only to emphasize the deductions made in the previous contribution, viz: that tumors of the pituitary body can be reached most easily by an infranasal route. In my previous contribution I discussed the various routes used by the individual operators and drew attention to the fact that those passing through the nose (von Eiselsberg, Schloffer, Hochenegg, Löwe and others) proposed a supranasal route, and in contradistinction I suggested an infranasal route which I had worked out upon the cadaver.

The technical procedure is not especially difficult if one has familiarized himself with the various landmarks. The supranasal route necessitates extensive removal of the intranasal structures as well as disfiguring incisions upon the nose which in the first instance favors a meningitis and in the second, offers the possibility of considerable deformity, while by using the method I have suggested, the scar left in my patient is absolutely unnoticeable to ordinary observation even at three weeks after the operation, and the nose is unaltered in shape and position. The turbinates and ethmoid cells were untouched and except for the subsequent local infection engendered by the nasal pack, and the hæmorrhage met with while the tumor was being removed, the operation presented no difficulties.

A post-operative consideration of these dangers leads me to suggest that the safest procedure in these cases would be secured by a two-step operation. The first stage should comprise the removal of the bony septum and the anterior wall of the sphenoid cells. The middle turbinates may also be removed if they seem to obscure the field. This can all be done without any skin incision. After the field has entirely healed, the second stage dealing with the sella turcica and the tumor can be carried out. It may not be impossible to do this without any skin incision after our knowledge of the operation and its post-operative sequelæ are better known.

In relation to this latter, another factor has been brought into consideration by the later investigations into the physiological properties of the secretion of the gland. Dr. A. E. Halstead has suggested that we do not know what the effect may be of the absorption of the excessive amount of secretion freed in the operation. It may explain the high temperature and collapse noted in some cases subsequent to operation.

HISTORY OF THE OPERATION

The patient was given urotropin for three days preceding the operation with the hope of lessening the chances of infection and was also given as much fluid as possible by mouth, before and after the operation, as there were a few granular casts in the urine.

There was no difficulty experienced in the administration of the anæsthetic, which was first given by mouth and then continued per rectum

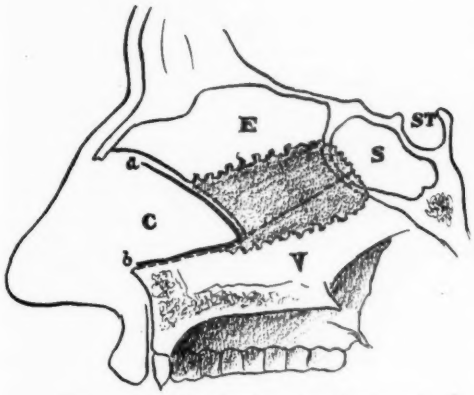


Fig. 1. Drawing showing plan of approach.

by Dr. James Churchill, after the method suggested[1] by Drs. Besley and Churchill. An absolute essential in this method is the complete evacuation of the intestinal canal, which should be begun two days before the period of operation. Smoler, in a recent issue of the Wiener Klinische Wochenschrift, reports a case which ended fatally, due to a pneumonia, and he is led to advise a preliminary tracheotomy for the administration of the ether as has already been done by others. Rectal anæsthesia precludes this danger and in the hands of Dr. Churchill has proven both safe and satisfactory in over seventy-five patients.

Shortly before the anæsthesia was begun the nasal cavity was packed with strip gauze saturated with adrenalin. This should be so thoroughly done that the gauze reaches back to the sphenoid foramina.

In the present case, when the nasal adrenalin saturated gauze pack was removed, preliminary to the incision, the nasopharynx was plugged by a gauze pack attached to a string after the usual method of inserting a posterior nasal plug. It was then pushed in tightly above the soft palate by the finger, inserted through the mouth. This controlled perfectly the escape of blood into the mouth and it was not necessary at any time to pay any attention to the pharynx.

The skin incision was made U shaped carrying the cut close under the alæ and close to the nose on the upper lip still preserving the anterior choanæ. As a result in healing, the scar contracted into the crease on either side and close under the nose and could hardly be discerned to ordinary inspection. The upper limit of the arms of the U extended only to the end of the crease made by the junction of the alæ with the face.

With a periosteotome the lower part of the nose was then separated from the bony nasal opening, it was still held in position, however, by its septum. A Ballinger knife was inserted and the cartilage cut from its attachment to the vomer and the perpendicular plate of the ethmoid. The nose was now turned up and held in position by a Jansen's mastoid retractor. It was not found necessary to remove the middle turbinates as I had anticipated. The lower part of the perpendicular plate of the ethmoid and the upper part of the vomer were bitten away by a bone forceps. The openings of the sphenoid cells were then located with a probe, the left cell opened by a chisel, and the anterior wall removed by a Hajek-Schmitheüsen punch forceps. The abutting nasal septum was removed with a biting bone forceps and the right cell then opened in like manner. Technically the procedure was most simple, although we were slightly bothered by blood running back into the field of operation, especially when the bony wall was removed, and in another patient I should be inclined to operate with the head elevated so that the operative field would not be the most dependent point.

The field of operation was found to be ample and clearly defined. The white posterior wall was plainly seen and even the angle shown by the X-ray plate was plainly evident. The distance from this point to the bony entrance as shown on the X-ray plate, had been previously marked on my chisel and this measurement corroborated our judgment as to the relations. This X-ray plate made by Dr. O'Donnell at the Michael Reese Hospital was of invaluable aid, and no operation should be attempted without such assistance. (See Fig. 2.)[2]

The chisel was directed against the lower part of the sella turcica and a slight blow carried it through the wall onto the tumor. The lower part of the anterior wall was then picked off by forceps and the floor removed by the chisel. Only slight hæmorrhage followed this procedure; not enough to be of any consequence if the head had been elevated to allow the small amount of blood to flow away from the field instead of into it. The bulging tumor appeared, being forced into the opening. A small, sharp spoon curette now entered the tumor mass and scooped out the bulging part. This was accompanied by considerable hæmorrhage, not alarming, but enough to obscure completely the field and necessitate working blindly. By packing and curetting alternately, however, a tumor mass the size of a large marble was removed. At the latter stage of this procedure the hæmorrhage became so profuse that the site was packed with strip gauze. The second hæmorrhage was apparently from some venous channel while the earlier one undoubtedly came from the tumor mass. The tumor hæmorrhage was explained later when the pathological examination showed the neoplasm to be a very vascular malignant growth.

Other strips of gauze were packed into the nasal cavity and all brought out through the anterior choanæ. The nose was then sutured in proper position by horse hair.

Post-operative course. The after course of the case as shown by the chart is in general as follows: In the first twenty-four hours the pulse varied from 54° to 72°; the respiration 16–18; and the temperature 97.6° to 100°. During the night the posterior nasal plug which had been left in came out during a coughing spell and was removed by the nurse.

The patient was somewhat soporose for the first three days. On the second day the temperature rose to 103.2°, the pulse and respiration being slightly increased; and on the third day it reached 104°. From this time it gradually fell, so that on the sixth day it was varying from 99° to 100.3°, and remained at normal until the twelfth day.

From the third day the patient became much brighter

[1] The Quarterly Bulletin of the Northwestern University Medical School. March, 1909.

[2] It is hoped that more definite data concerning the anatomical relations will be furnished by investigations now being carried on in the anatomical laboratories of the Northwestern University Medical School.

than before the operation, slept only the normal number of hours, although previous to operation he slept or was soporose most of the twenty-four hours.

The face was considerably swollen. This however also subsided by the end of the week, with the exception of the right eye which remained somewhat œdematous. The amount of vision seemed to be about the same during the after course as before the operation, although the patient himself stated that the vision was better in the left eye. The right eye, which was blind before operation, remained unchanged.

By the fifth day all of the gauze was removed from the nose except the piece directly down on tumor. An attempt was made on the ninth day to remove this but it was followed by considerable hæmorrhage and it was replaced. This attempt was followed in two days by a chill and a rise of temperature to 103.6° which gradually subsided in two days to 100°, and remained at about that stage for several days. There has been no evidence of meningitis or sinus thrombosis at any time, but at the end of two weeks the soporose tendency became more noticeable, so that at two and a half weeks after the operation, the patient's wife stated that he slept then about as much as before operation.

The urine being examined at this time showed numerous hyaline and granular casts with a trace of albumen, and the amount varied from eight to twelves ounces daily, in spite of the large amount of fluids the patient was taking. The question arose as to the cause of the soporose tendency, whether it was due to uræmia or a rapid return of the tumor. Dr. Grinker and Dr. Stubbs who saw the case with me, were inclined to the view that it was due in large measure to the growth of the tumor. In this decision, considerable weight was given to the facts that we now knew that it was a sarcoma and also that it had grown very rapidly before the operation, the rapid loss of vision and severe change in the symptoms and signs, all coming on within less than a month before the operation. The question of a second operation was considered, but owing to the tumor's rapid growth it was thought to be inadvisable.

A note made a month after the operation states the patient shows a steady increase of the soporose tendency, although he answers questions rationally when aroused. He has shown delirium on one or two occasions and is evidently slowly pursuing a downward course. His temperature is normal, he takes food freely and, except for his soporose tendency would be considered to be in good condition.

The patient died one week subsequently and, unfortunately, a post-mortem could not be secured.

PATHOLOGICAL REPORT

The tumor tissue removed at the operation was submitted to Prof. F. Robert Zeit of the Pathological Department of Northwestern University Medical School for his opinion, and his report is as follows:

"The fragments of tissue from a tumor of the hypophysis, submitted to me for examination, show an entire absence of the normal histological elements of hypophyseal tissue.

"The tumor consists principally of large round cells, 8 to 10 μ in diameter, with large vesicular nuclei, rich in chromatin, of embryonic type. Here and there some spindle cells with large egg-shaped nuclei are seen. The blood-vessels traversing the cell masses have no muscularis or adventitia. Between the cells a very delicate reticulum of fibrilar basement substance is seen everywhere. The tumor cells are, for the most part, packed closely together. Some have two vesicular nuclei: karyokinetic figures are seen in some of the cells.

"Diagnosis: Large round cell sarcoma."

I wish to acknowledge my great obligation to Dr. F. Gurney Stubbs and Dr. H. M. Richter who assisted me in the operation. At my request, Dr. Stubbs in his capacity as rhinologist examined the nose some days after the operation and reported as follows:

"In examining the case of Mr. Olsen, operated on by Dr. Kanavel, on the fifteenth day, I find conditions as follows:

"The external wound entirely healed and scar scarcely noticeable. Anterior choanæ normal, cartilaginous septum restored to median line and the union complete where it had been severed along its lower attachment. The anterior edge of the perforation in bony septum clearly discerned and somewhat movable. Small piece of cotton packing remaining in the sphenoid cavity easily seen and manipulated equally well through either naris. The lower turbinates had not been disturbed during the operation. The middle turbinates seemed apparently uninjured by the trauma of the operation. They were in normal position and only lacked their anterior ends; in other words, the nose seemed to be in almost as good condition as before the operation, minus the resected part of the bony septum.

"Externally the nose showed absolutely no signs of an internal operation."

CLINICAL REPORT (Grinker)

For permission to study and report this interesting case I am indebted to Dr. R. Patillo and Dr. A. A. Goldsmith, both of the Chicago Post-Graduate Medical School.

Summary of Symptoms: Male, aged 43, with negative family and personal history, develops short fainting spells, accompanied by disturbed vision in the form of black spots before his eyes. Somewhat later dull headaches appear at irregular intervals, interspersed, however, with occasional severe cephalalgias, of sufficient intensity to prevent sleep. Still later there occur dull pains and drawing sensations in bones and joints. In March, 1909, visual disturbances of a progressive character become more pronounced and eventuate in distinct bitemporal hæmianopsia. There also appears apathy, somnolence, and general mental and physical asthenia. Then remission of subjective symptoms for a period of three months. Thereupon recurrence of symptoms; this time, however, with vasomotor disturbances, progressive blindness and complete loss of vision in the right, with partial nasal vision only remaining in the left eye.

CASE. Patient, a carpenter, aged 43, first came under my notice June 4, 1909. In April of the same year he sought relief for eye symptoms in Dr. R. Patillo's clinic, who, having recognized the case as one of great medical interest, referred the patient to Dr. A. A. Goldsmith's medical clinic. The diagnosis of probable tumor of the hypophysis having been made, Dr. Goldsmith kindly placed the case under my observation.

Family history. Father and mother died at 74 and 76 years, respectively. Grandparents reached old age.

Fig. 2. X-ray photograph of patient's skull taken before operation. Notice the large size of the sella turcica which is outlined by the white line and indicated by the arrows.

There are still living and healthy three brothers and two sisters; none died.

Past history. Patient was well until 13 years ago when he had an attack of gastroenteritis lasting one week. No recurrences. About eight years ago he suffered from acute articular rheumatism, which disabled him for about four months. His habits were exemplary in every respect; he never drank nor smoked to excess, but was always a moderate user of snuff tobacco. He never sustained a serious trauma, nor was he ever a subject of venereal disease.

Present illness. After a searching inquiry it seems probable that the beginning of the present trouble dates about one and a half years ago, though characteristic symptoms, from a diagnostic point of view had made their appearance only within the past eight months. As the earliest symptom in this case I regard what the patient described as repeated "fainting spells" lasting but a few moments, during which he usually perceived black spots before his eyes. During the past year dull headaches were frequent and for a period of seven months intense cephalalgias alternated with the milder headaches, the former often preventing sleep. Additional symptoms noted since the advent of the severe headaches were, drawing sensations and peculiar discomfort in bones and joints; further, well-marked apathy and tendency to sleep more or less continuously. The patient himself described his pains as rheumatism and the somnolency as sleeping spells.

About the middle of March, 1909, he experienced marked losses of vision; objects appeared blurred and indistinct and he had a sensation as though he was looking through smoke. Indeed, he is certain that for a short period he was entirely blind in both eyes, but imperfect vision slowly returned and then remained stationary. In describing the eye symptoms he placed no emphasis on any existing differences between the outer and inner fields of vision.

On the part of the mental functions the only complaints were a certain degree of inability for sustained mental con-

centration and a marked reduction in his ability to remember recent events.

Examination. The appearance of the well-developed man, weighing 177 pounds and measuring five feet ten inches, with a large face and head, sluggish movements and slow speech, suggested at first the picture of an acromegaly case. However, an examination which included careful measurements, found hands and feet of normal dimensions. The face seemed a trifle long, the forehead, superciliary ridges, nose, and ears appeared rather more prominent than in the average individual. There was also a slight degree of prognathism, but no widening of the interdental spaces,— a sign first minutely described by Dr. W. W. Graves as indicative of incipient acromegalic enlargement of the maxillary bones. The tongue was not hypertrophied, but speech was of low pitch and monotonous. There was no dribbing of saliva, no kyphosis, and no enlargement of the upper end of the sternum, nor any dullness over the same. The sexual organs were normal in development and function. From these findings, both positive and negative, one is justified in concluding that there was a mere suggestion of acromegalic disturbance in our patient.

An examination of the viscera disclosed nothing abnormal in heart, liver, kidneys, spleen, and intestinal tract. Blood and urine showed nothing pathological. The blood pressure was within normal limits, though the pulse was rather slow, ranging in frequency from 50 to 60 beats per minute. The glandular and osseous systems were free from suspicious swellings.

Nervous system. Irritative motor phenomena, such as tremors, choreiform movements, twitchings, nystagmus, were absent. There were no motor palsies or paralyses of any kind. All of the reflexes, both superficial and deep, approximated to normal values. General sensation was not affected in any of its qualities. There were no disorders of co-ordination, nor of equilibration. No signs of anarthria, dysarthria, or aphasia could be detected. Neither polyuria, polydipsia, nor polyphagia was present. Mental tests failed to prove any abnormalities.

With the exception of the visual apparatus, the special senses were in no wise affected. The pupils responded well to the light test and also in accommodation.

The opthalmoscopic examination revealed a general whiteness of both disks, with distinct definition of their borders. To my non-opthalmologic eye there were not discernible any differences in the degree of optic atrophy of either half of the fundus. Evidences of a past or present papilledema, or choked disk, were certainly wanting. A rough functional test revealed the existence of blindness in the outer field of each eye (bitemporal hæmianopsia), also a marked narrowing or contraction of the nasal field of the right eye for colors and objects.

An excellent radiogram taken in Dr. Max Reichmann's Roentgen laboratory, showed distinct enlargement of the sella turcica.

Further observations. For a period of three months from the time of my first examination the symptoms remained practically unchanged. As the headaches, previously so annoying to the patient, became less frequent and less intense, it was hoped that the disease had probably become stationary. Partly in order to determine the advisability of operation and partly for the purpose of stimulating research into the best methods of approach to the hypophyseal region, the patient was subsequently placed under the direct care of Dr. Allen B. Kanavel.

Fig. 3. Photograph of patient taken two and a half weeks after operation. Notice the absolutely perfect outline of the nose and the absence of any scar.

While the remission of subjective complaints continued, neither patient nor physician were very urgent in advocating operative procedures. But, as in many another case recorded in the literature, the remission proved to be only temporary. Headaches again became frequent and severe, aching in the long bones reappeared and, what was worse, vision began to fail even more rapidly. So rapid indeed was this downward course, that on the occasion of my presentation of the patient before the Chicago Medical Society in October, 1909, I was surprised by the discovery of an enormous shrinkage of the right nasal field.

Additional notes made November 10, 1909, that is, tw days before operation: Vision in right eye, both temporal and nasal, completely lost. In the left eye there remains vision in part of the nasal field only. Headaches and general aching of limbs are continuous, though not severe. Memory poor. Mentality sluggish; has occasional difficulty in finding words to express routine desires. Has become impatient and irritable. Drowsiness is now constant, although the patient can be readily aroused. Additional symptoms not previously noted are, recurring vasomotor disturbances in the form of profuse sweatings and coldness of extremities. Repeated inquiry failed to elicit any positive information relative to the previous existence of any form of tumor in his ancestry or his own person. The only statement which may possibly have some bearing on this question was that in April of this year he had suffered from an attack of tonsilitis and that his left tonsil was amputated when the inflammation had subsided. Is it not possible that the diseased tonsil was the seat of a sarcomatous growth, primary or secondary? As I have been unable to obtain definite data, this will probably remain an unanswered question.

EXTENSION BY MEANS OF THE NAIL

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Translated for Professor Anschütz by Herbert A. Potts, M. D., Associate in Surgery, Rush Medical College

THE extension by means of adhesive plaster, as recommended by Bardenheuer, is being more and more recognized as the standard method of treating fractures of the limbs.

We employ it at least in cases of dislocated epiphyses as early and as energetically as possible, and are almost always satisfied with the results obtained.

There are, however, cases, viz., complicated fractures with extensive laceration of soft parts in which the adhesive plaster extension cannot be used at the outset, or where its continuous use is impractical on account of accidental pathological conditions such as erysipelas or phlegmon, intercurrent diseases, pneumonia, delirium, etc., or cases which do not promise good results, such as old fractures with marked contraction of the soft parts, or, lastly, in those which for any reason sufficient extension cannot be brought to bear, be it because local conditions are not favorable (fractures of the ankle-joint with marked dislocation of lower fragment of femur, arm, etc.) or be it that the treatment instigated by the first physician who saw the case has fallen short of a perfect result.

In many of these unfavorable cases in which well known methods of extension have been insufficient the nail extension method, first reported by Codivilla of Bologna, and now recommended by Steinmann of Bern, will bring about good results.

It is a valuable adjunct to the extension method and its application especially to linear dislocations seems to be of greatest importance.

TECHNIQUE OF NAIL EXTENSION

By this new method the weight is attached directly to the distal fragment by means of a nail which is driven through the bone; the nails are either angular or flat and 4.20 cm. long.

One may drive a nail into the bone on either side, or drive one nail entirely through the bone and soft parts, or as Becker recommended, drill through the bone allowing the drill to remain, the extension being applied to the ends of the drill as they project from either side.

One nail or drill is better than two smaller nails, for the reason that the smaller ones become loose from absorption of bone.

The drill is passed through the spongy portion near the epiphyseal line, the nearer the compact bone the better, as less pressure atrophy results than when the drill is entirely within the spongy portion.

In fractures of the femur the drill is passed one handbreadth above the line of the joint, in fractures of the leg below the knee, either through the tibia or os calcis.

Codivilla and later Kirschner recommended that the drill pass through both fragments in order that counter extension may be applied directly upon the fractured bone, thereby avoiding any traction upon a joint. The result of the extension can be retained by placing a plaster bandage between the nails, which impinges upon them and does not allow them to approach each other when the weights are removed.

I have so far found it necessary only in fractures of the femur to employ extremely heavy weights. The hip-joint supports sufficient counter extension, but in fractures below the knee I should recommend if heavy weights are to be used, that nails be placed both above and below the fracture, because the knee-joint does not well withstand such extension.

We have employed the electric motor, others recommend the hand drill. The operation can be easily done under local anæsthesia.

In order that the cords which bear upon the drill may not slip off, some provision should be made, such as screwing a nut upon either end. See Fig. 1.

As to how much weight one must at first employ, it is difficult to determine; in fresh fractures much less is required than in old ones.

We begin with smaller weights and gradually increase them during the first or second day, carefully and frequently controlling each individual case.

We have frequently observed a diastasis of the fragments, which in itself amounts to nothing, as the fragments return to apposition as soon as the weight is lessened.

In fractures of the femur we, as well as Steinmann, have found 15 kilo (32 lbs. approx.), for fractures below the knee 10 kilo (26 lbs. approx.), sufficient.

At times we have used 25 kilo. When, by the

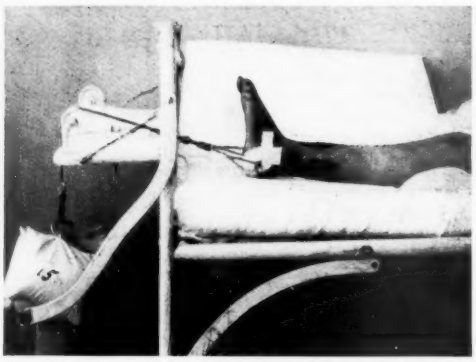

Fig. 1. Nail extension in complicated infected fracture of the leg.

prolonged action of heavy weights the linear dislocation has been corrected and callous formation begun, the heavy weights may safely be replaced by lighter ones.

Moreover, lateral dislocation and bending can be corrected by placing more weight upon one side or the other, or by slipping the cord out near the end of the nail, using it as a lever. It is, however, better to keep the cords closely applied to the limb, thereby avoiding the possibility of breaking the nail and, if necessary, apply lateral weights either direct as shown in Fig. 2, or acting over a pulley in the desired direction.

ADVANTAGES AND DISADVANTAGES OF NAIL EXTENSION

The general use of the method will depend upon the weight of argument for or against it. On the face of it it seems cruel and dangerous. To most everyone, ourselves included, the method a priori seems productive of much pain to the patient. As a matter of fact this is not so. Not one of our patients has complained more than the ordinary patient who has the adhesive plaster extension applied. Children also complain little of the treatment. It is certain that the pain produced is in no way a contraindication to its employment.

The greatest consideration is in regard to the danger of infection. In the light of modern views on asepsis and infection some anxiety may be rightfully caused by driving a nail through the skin into the bone or entirely through the limb and allowing it to remain for weeks.

It was with trepidation and fear that we first employed the method in a case in which it seemed impossible to bring about a good result by ordinary methods, but we are now convinced that the danger of infection is very slight, much less than it a priori appears. However, the danger from infection is not to be denied. We had one slight infection at the site of the nail.

We do not employ nail extension in fresh uncomplicated fractures, especially when the nail must necessarily come near the hæmatoma. An unfortunate case of Schwarze's proves that secondary infection of the site of the fracture may occur.

The direct results of the traumatism are allowed to subside before the nail extension is applied, and we are convinced that cases, weeks after the injury, are still amenable to the treatment.

Since there is a danger from infection, we cannot at this time recommend that the nail extension should be generally used without strict indications for it. Further, on account of lack of sufficient experience, we cannot say whether the joint function may or may not be interfered with by the nail's proximity to it.

However, as in all our cases, when it seemed that by the use of other methods a faulty healing must result, we are justified in choosing between the

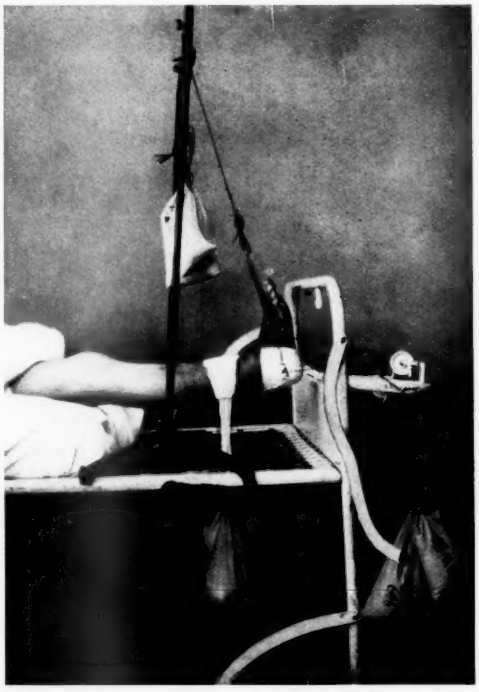

Fig. 2. Fracture with posterior dislocation of the foot.

two evils, viz.: Possibility of infection and the possibility of a transient limitation of motion in the joint, in order to give the patient the benefit of the advantages of the nail extension. There are few other contraindications.

The advantages, however, outweigh the disadvantages, and foremost of these is the fact that the extension comes only upon a small portion of the lower fragment leaving the rest of the limb free. Furthermore, it allows of an energetic extension in cases of complicated fracture (see Fig. 1), which by other methods is impossible.

The second and most important advantage is that the method is not confined to the treatment of fractures, but may be employed generally in surgery of bone where it allows the application of great force when necessary.

In this relation it overcomes most satisfactorily within a few days the contracture of the soft parts, so frequently seen in old fractures, an obstacle which was before held as insurmountable.

The number of my observations is not great, only twenty cases, but in all of them there were direct indications for the nail extension, either where the customary adhesive plaster extension was impossible of application or where it failed to bring about the desired result.

I venture to assert that my results may have some worth and may be of general interest.

The cases group themselves into five groups.

GROUP 1. FOUR CASES OF OLD FRACTURES WITH PSEUDOARTHROSIS AND DELAYED UNION

M., 26 years old. Fracture leg below knee. Accident October 13, 1908. Admitted eight weeks later. Both bones broken, middle, and very movable. Shortening 4 cm. Œdematous. (See Fig. 3.) December 11, 1908, in narcosis, mobilized. Extension upon nail driven through both bones above malleoli. Ten pounds put on immediately, which in the evening was increased to twenty. No pain. (See Fig. 4.) December 12, 1908, lateral pressure. December 14, 1908, shortening completely overcome, ends of fragments in contact, but some lateral displacement. December 21, 1908 (ten days), position satisfactory; beginning consolidation. Has had no pain. January 2, 1909, nail withdrawn; skin wound free from irritation. Point of fracture elastic, massage, mechanotherapy. February 14, 1909, discharged healed, callus hard, no shortening. (See Fig. 5.)

Beside this were two cases of pseudoarthrosis of the femur with 4 and 10 cm. shortening, respectively, whose accidents were four months previous.

These were treated with nail extension with thirty pounds weight. After four weeks the one had elastic callus which in two weeks more was completely solid. The other, with 10 cm. shortening, was completely corrected but still had a pseudoarthrosis because some soft parts interposed; these were removed by operation. Discharged healed, with only 2 cm. shortening.

After such good results in the first two cases,

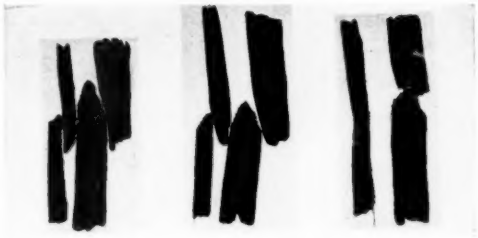

Fig. 3. Fig. 4. Fig. 5.

and the favorable one in the third, I consider the nail extension a great help in the treatment of pseudoarthrosis and recommend its trial before a bloody operation be attempted, especially as it was seen in this case that it placed the fragments in a more favorable position for the cutting operation.

The following case is of particular interest:

A frail man of 63 years, suffering from a fracture at the lower third of the femur, was treated by means of adhesive plaster extension, but on account of pneumonia with pleurisy and weak heart the plaster was removed after three weeks. This resulted in a shortening and bad position of the fragments. The adhesive plaster was again applied, but to no avail, therefore nail extension was substituted. After nine weeks the callus was springy but quite solid; no shortening, but some lateral dislocation.

Everyone can call to mind similar cases of fracture with dislocation in which, on account of some intercurrent malady,— delirium, erysipelas, pneumonia, or injury — the adhesive has been removed for some weeks, after which a poor result, such as shortening, faulty position of the fragments, or delayed union has occurred.

In such unavoidable and unhappy cases the nail extension seems to be of especial value. It is hoped that we can by this means give a better prognosis in cases of old fracture with delayed union.

GROUP 2. FIVE CASES OF COMPLICATED FRACTURES

The nail extension was of great advantage in a case of complicated fracture of the leg below the knee in which the skin wound was dirty, the bone fragments were exposed, and immediate treatment was a necessity.

In this case the nail extension was particularly advantageous because the local conditions allowed only a small space upon which means of extension could be attached. Energetic extension in this case being at this time secondary in importance, Fig. 1 shows how simple and secure the management was.

Fig. 6.

Fig. 7.

In another case it was possible to employ it in spite of a phlegmon in the leg. The linear dislocation was corrected, but on account of intervening soft parts the lateral dislocation remained even after many trials during which the ends of the bones were separated from each other (diastasis).

The nail extension was also of great benefit in a double fracture of the humerus with a complicated fracture of the forearm.

This case recalls to mind many complicated fractures of the leg above and below the knee which resulted badly simply because of a lack of normal skin upon which the adhesive could be applied.

Usually in such cases one waives adaptation of the fragments and directs his attention to the treatment of the wound, using either a simple splint or an open plaster cast.

Many times one resorts, even under the unfavorable circumstances, to bone suture only to bring the fragments more closely together. The employment of nail extension offers two possibilities which tend toward a better prognosis in severe cases of complicated fractures.

When the case permits of it, the nail extension is immediately applied and does not in any way interfere with the treatment of the wound.

Secondly, when the local conditions do not permit even of the nail extension the wound can be treated in a simple splint or cast and later, when the skin wound has healed or at least much improved, the nail extension can be employed for the correction of the deformity.

We believe that the shortening in the most severe cases, even after the removal of a large sequestrum, may be avoided. The excellent results shown in group 4 seem to warrant this belief.

GROUP 3. RECENT FRACTURES WITH UNSATISFACTORY RESULTS OF CUSTOMARY TREATMENT. FOUR CASES

This group comprises four cases in which the adhesive plaster would not permit of sufficient local conditions (excessive fat development in a weights being applied on account of unfavorable case of fractured femur, fracture of ankle-joint with dislocation, and fracture of leg below the knee).

It is of great advantage that the nail extension can be applied at most any time, rarely is it too late.

In the case of a very corpulent man with a fracture at the lower third of the femur, it was impossible, in spite of fifty pounds weight with lateral pressure, also several trials in narcosis, to correct the shortening.

Such a case is usually treated very satisfactorily by the method of Bardenheuer. Nail extension was employed, the weight being gradually raised from twenty to fifty pounds. A diastasis of one-half cm. resulted. It was found that thirty pounds was sufficient to retain the fragments in position, after five weeks the fracture was healed, with a slight posterior displacement of the lower fragment, but no shortening.

In a fracture of the internal malleolus with fracture of the anterior border of the tibia, a splitting of the astragalus with right angular dislocation of the fragment and forward dislocation of the foot (see Fig. 6) it was impossible, by ordinary methods, to reduce the fragments. A nail was driven directly through the astragalus upon which energetic extension was applied, and the fragments resumed their normal positions in which they were easily held. (See Fig. 7.) The procedure resulted in a functional cure with good movement of the joint, which, from the severity of the case, at first seemed impossible.

In another case of fracture of the ankle-joint with severe backward luxation of the foot, we at last used nail extension. Fig. 2 shows the manner in which the weights were brought to bear. In our opinion the most important point is the employment of great weight for extension and this case could have been handled by no other method as well as by the nail extension, the nail being driven through the os calcis.

Codivilla recommends this procedure for fractures higher up. I doubt if this spongy bone is able to withstand the weight necessary for fractures of the femur for the sufficient length of time.

In one of our cases, the nail, by pressure atrophy, passed through the bone, however, without following disturbance of function.

GROUP 4. THREE CASES OF OLD FRACTURES WITH BONY UNION AND DEFORMITY

In order to correct the deformity one must first resort to osteotomy. Our method is to approach the callus from the side, protecting the muscles, after partially sawing the bone, produce a spiral fracture by torsion, which with the chisel as a lever is easily accomplished. The bone is then drilled through and weights added under careful control of the blood-vessels and nerves.

The following case is of great significance:

On the 27th of July, 1908, a boy of 16 years met with an accident, being run over, and suffered a complicated

fracture of the femur; the wound of the skin and soft parts was dirty and wide open, the bones and large vessels lay free in the cleft, there was also an epiphyseal separation at the lower end of the tibia. Septic fever. Ordinary extension. On July 29, 1908, an attempt to suture the fragments was made; limb placed in splint; again high fever. Large gangrenous masses and a total sequestrum 5 or 6 cm. long were thrown off. The limb was fixed in an open plaster Paris splint. Gradual healing in poor position with shortening, discharged in plaster Paris splint.

September 5, 1909, returned with varus of femur, shortening of right leg 15 cm., of which about 3½ cm. was from the tibia. Knee stiff, some lack of motion in ankle-joint. (See Fig. 8.)

September 26, 1909, osteotomy of the callus after the artery and vein were freed from the scar tissue which was fast adherent to the bone. Drill inserted through femur about a handbreadth above line of knee-joint. Extension of about 11 pounds increased to 30 pounds applied. Much pain, for which much morphine was necessary.

October 26, 1909, beginning consolidation. Still some shortening. Mobilized in narcosis and 11 pounds again put on for extension. November 1, 1909, callus again hard. November 15, 1909, nail easily removed. Shortening 4 cm. Femur of nearly normal length. November 20, 1909, skiagraph shows nearly a normal femur. (See Fig. 9.)

It is interesting to note that after the removal of a sequestrum 5–6 cm. long, which resulted in a shortening of 11 cm., the configuration of the bone after the nail extension was nearly normal.

I hope after osteotomy upon the likewise shortened (4 cm.) tibia to restore its normal length, which beautiful result without the nail extension is impossible.

This case may be taken as an example showing how much better the prognosis in severe complicated fractures may become under the new method.

In another less severe case of completely healed fracture of the femur with 3½ cm. shortening, viz.: a cavalry officer whose injury was four and a half months previous, an osteotomy and nail extension procedure was undertaken, with the result that not only was all shortening overcome but also a genu valgum corrected, which condition preceded the fracture. The nail remained in place four weeks. At first thirty-five pounds was applied, and after some hours fifty pounds. After eight weeks the callus was hard, and he walked about with the aid of mechanical help. (Mechanotherapy.)

GROUP 5. FOUR CASES IN WHICH OTHER USES OF THE NAIL EXTENSION WERE MADE

The nail extension was used in a case of old posterior luxation of the shoulder with fracture of the tuberosity, which could in narcosis be reduced but would not stay in place. (Two small nails were driven into the radius and ulna.) It was also used in a luxated femur.

The following case seems to be of greater surgical interest, as it prompted us to undertake measures for correcting the shortened bones.

The observation of diastasis of the fragments during nail extension in fractures of the femur led us after chiseling through the femur to employ the method with a view of lengthening the bone.

Fig. 8. Fig. 9.

CASE 10. Ten year old girl. Shortening of leg 10 cm., due to a large ecchondroma involving lower end of right femur and upper part of tibia. Varus and lack of development. Tumor, which was well marked in skiagraph, was removed at several sittings. Upon admission to the clinic in March, 1909, shortening was 10 cm. (9 cm. in femur, 1 in tibia). Femur sharply convex. Knee-joint limited in flexion with abnormal lateral motion.

March 11, 1909, operation. Step-like saw-cuts 8 cm. apart. Bone separated between saw-cuts. (See Fig. 10.) Bone marrow macroscopically normal. It was possible, by manual manipulation, to separate the ends of the bone only 1½ cm. Primary wound closure. Femur drilled through handbreadth above joint line. Drill allowed to remain. Ten pounds extension. In order to control the direction of force a light adhesive plaster extension was made upon the leg below the knee. Under careful control of blood-vessels and nerves, on the 13th, fifteen pounds was applied, on the 17th, twenty-one pounds, later in the day, twenty-four pounds. On the 30th, bones in good position. Skiagraph showed 9–10 cm. lengthening with beginning callus building. April 26th, nail extension removed and adhesive plaster supplemented until May 20th. Position good; callus hardening. June 8th, allowed upon feet with a Thomas splint. Discharged. Bones in good position with 2 cm. shortening. Result, leg has been lengthened 8 cm. Patient can lift leg very well. July 3d, consolidation increased; shortening 2 cm.; discharged in a Thomas splint.

The attempt to lengthen bones by means of oblique osteotomy has often been made, but I know of no case in which such a good result has been obtained as in the foregoing one.

This excellent result prompted me to attempt to correct a much shortened leg with club foot in which an osteoplastic ankle resection after Waldimiroff-Mikulicz had been done.

An osteotomy with step-like saw-cuts was done on the tibia, and by means of nail-extension a lengthening of 3 to 4 cm. was attained. The

Fig. 10. Fig. 11.

result is not entirely satisfactory, because at least 3 or 4 cm. was lost by the (extirpation of the astragalus) bolting of the joint. The patient now does not need a complicated mechanical device, only a thick sole.

There is a large group of cases which I wish to point out as being amenable to treatment by nail extension, although I have none such to report, viz.: gunshot fractures, especially splintered fractures with severe injury to the soft parts; in time of peace when such cases come singly and there is time to carefully treat them less than in time of war when the cases are increased, as in an epidemic. Later experiences have again pointed out the truth of the principles upon which von Bergmann based his treatment of gunshot fractures. The simple immobilization in a plaster cast has been of inestimable value in hundreds of cases, but it influences the result in severe dislocations by the unavoidable shortening which occurs.

When one immobilizes the parts in spite of the unavoidable shortening which results it is in order that infection and disturbance of wound-healing may be avoided.

On the other hand there are often many reasons why a complicated extension bandage cannot be employed or cannot be continued throughout the case if it is applied.

We believe that in these many cases the nail extension will be found to be of great service. It allows, best of all, the practice of the ground principles of surgery in such cases, the waiting until active inflammation has subsided, then two or three weeks later the dislocation — at least the linear dislocation — may be reduced.

It is important that further observations be reported. After all with all its advantages it is not entirely free from danger, and cannot at this time be recommended as a routine practice in dislocated fractures.

It requires careful control and observation. It is therefore not intended to replace the established methods of extension, but it is to be reserved as a valuable complement in cases in which for any reason other methods are less applicable.

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APRIL, 1910.

OPERATIONS FOR BRAIN TUMORS[1]

In considering operation for brain tumor we should bear in mind that we are dealing with a lesion that must in course of time prove fatal, and usually within a short time. Tumors of the pituitary body frequently seem to be of slower development than are new growths in many other parts of the brain. Acromegaly is a condition of slow development and long duration, and while a tumor of the pituitary body is not found in every case of this disease, it not rarely seems to be the cause, and when present does not appear to hasten greatly the fatal termination. Frequently cessation of menstruation is the first sign of tumor in this region of the brain, and it may precede the other symptoms for many years. A tumor of the pituitary body may attain considerable size without causing many symptoms, and a bitemporal hæmianopsia may be its only sign for a long time. The sella turcica is enlarged by pressure from the growth, and the hæmianopsia may in this way become less by relief of pressure on the chiasm. This variation in the hæmianopsia sometimes perplexes the clinician. The third ventricle is above the pituitary body, and a tumor may grow to large size in this ventricle before it produces many symptoms. For these reasons one may hesitate before attempting to remove a tumor from this region. The operation in whatever way it may be undertaken is very serious, and while a few successful cases are on record, we can not forget the grave danger in surgical intervention. It is important to keep in mind that because of the relations referred to above, grave symptoms of tumor of the pituitary body are likely to indicate a large growth, and that operation would be much more promising if bitemporal hæmianopsia were the only sign. Bitemporal hæmianopsia may be produced by meningitis, fracture of the base of the skull, or aneurysm, but is strongly suggestive of tumor when developing slowly and without a previous trauma of the head, especially is this true if to the bitemporal hæmianopsia complete blindness of one eye be added, indicating complete loss of function of the fibers in one optic tract, or if primary optic atrophy instead of papillœdema be present. In some instances, as in a case reported recently by Gowers, primary optic atrophy may be observed on the side on which the tumor is larger, and papillœdema on the other side where the tumor is sufficiently far from the papilla to permit papillœdema to develop. In this case skilfully diagnosed by Gowers, operation was performed by so ex-

[1] Remarks made with a lantern demonstration at the annual meeting of the Medical Society of the County of Rensselaer, Troy, Dec. 15, 1909; and later at a meeting of the College of Physicians of Philadelphia.

perienced a cerebral surgeon as Horsley, and yet it resulted fatally.

Statistics as now given regarding operation in cases of brain tumor are unreliable, because infiltrating and well defined tumors are included in the same tables, and little attention is paid to the mortality depending upon the position of the tumor.

The statement that operation is more likely to be successful when the tumor is small hardly admits of dispute, but it is not always easy to make the diagnosis in the early stages, and frequently the patient is not seen by the neurologist at this period. Symptoms which to an experienced physician are very suggestive of tumor, may be attributed to gastric or hepatic disorder, to nephritis of pregnancy, or some other cause; and tumor especially of the cerebellum, may produce a condition of the retina resembling albuminuric retinitis.

It may not always be remembered that sudden death is common in cases of tumor in any part of the brain, but chiefly when the tumor is in the posterior cranial fossa. There is less room here than in any other part of the cranium for a new growth, and increase of intracranial pressure therefore occurs more rapidly, and the respiration and cardiac action may suddenly become seriously impaired.

It is wise always to present the condition clearly to those who may be responsible for the patient, and often to explain the condition to the patient himself if he be intelligent. One will frequently find that an intelligent person will demand that the chance of operation shall be given to him, even though he fully realize how serious a surgical intervention may be. He recognizes on the one hand that he has a cerebral lesion which must prove fatal, and that the end may come suddenly within a few days, a few weeks, or after a longer period; that while he lives he must suffer great impairment of function in important structures and probably great discomfort, especially in headache, nausea. and vomiting. On the other hand he knows that surgery may give him a chance for his life or for temporary relief, and he gives no choice to the physician, but demands as his right that the chance be given to him. More than once the surgeon will be told by the patient that no effort to remove the tumor is to be slighted, and that death would be preferable to a continued existence in his deplorable state.

There is no denying that the mortality in operations for brain tumors is high, but it is not so high as the mortality of tumor cases without operation, which approaches 100 per cent. Surgical technique has been so greatly improved in recent years that operations for tumors have become almost a special branch of surgery. The success of surgical intervention will depend chiefly on the correctness of the diagnosis, on the position and size of the tumor, and on the skill and experience of the surgeon. The neurologist must strive to make his diagnosis at an earlier period in the development of the tumor, and should not wait until all the important signs of increased intracranial pressure have developed, and to these are added many sharply focalizing symptoms. In the early stage of tumor general signs of intracranial pressure may be entirely absent, and there may be no headache, no nausea or vomiting, no papillœdema. A slowly developing focal symptom or focal group of symptoms may be sufficient for exploration, and this is especially true if the lesion be diagnosed as being in an accessible portion of the brain. Convulsions confined to one limb, or both limbs on one side of the body, or also to the face on the same side, and occurring repeatedly, indicate irritation of the opposite motor region of the cortex; and while the source of this irritation is not always detectable, a cause must be present. Such convulsions are not always produced by tumor, but frequently are so pro-

duced, and at least twice in the writer's experience were the only important sign of a tumor discovered at operation. The motor region is easily exposed and little damage is likely when an osteoplastic flap is made, provided the patient's general condition permits operation. The scar from this operation may almost disappear and may be detected only by careful search, even a short time after the operation. It is probably a wise procedure to expose the motor cortex when the convulsions are strictly Jacksonian in type and of frequent occurrence. Unquestionably a tumor will not always be found, but if we expect to operate early we must be prepared to take more chances than in a case easily diagnosed by a first year medical student, and yet rashness is not justifiable.

A paræsthesia confined to the distribution of the fifth nerve, followed after several months by anæsthesia in the distribution of this nerve and paralysis of the muscles of mastication on the same side, indicates a lesion paralyzing the fifth nerve. In the writer's experience this symptom-complex has been produced by basal syphilitic meningitis, but it is more likely to be caused by tumor. When the Wassermann reaction is negative and the anti-syphilitic treatment has failed, the diagnosis of a tumor in the region of the pons may be considered probable, but a negative Wassermann test does not necessarily exclude syphilis of the brain. It is not easy to determine at first whether the tumor be in the pons or growing from the dura over the petrous portion of the temporal bone. Glioma within the pons does not destroy all the area in which it develops, and trigeminal disturbance may be the most pronounced sign of glioma of the pons, but some weakness of the opposite limbs is likely to develop soon. Tumor growing in the region of the petrous portion of the temporal bone usually causes pain in the distribution of the trigeminal nerve from irritation of this nerve, but in one of the author's recent cases pain was absent. A tumor in the middle cranial fossa may implicate the bone, and in the writer's experience has extended into and partly filled the nasal cavities.

The greatest difference in symptoms may be occasioned by a tumor just above the tentorium and one just below this membrane. When below, the symptoms usually are very characteristic, and are such as cerebellar ataxia, unilateral nerve deafness with facial palsy on the same side, early papillœdema, nystagmus, vertigo and severe headache. A tumor growing above the tentorium, from the floor of the middle cranial fossa, may develop to a large size with few symptoms, if it does not implicate the trigeminal and abducent nerves. Here it forms a nest for itself in the basal part of the occipital lobe by atrophy of the overlying lobe, and as the optic radiations do not extend to the base of this lobe hæmianopsia may not be present. Papillœdema and headache may be the first signs of a growth in this region, and when the patient comes under observation the former may have attained so great a degree as to mask a hæmianopsia that had been present. The tumors at the base of the occipital lobe are very likely to escape detection when small.

The endothelioma is probably the most favorable tumor for operation. It does not infiltrate the brain, it grows from the dura and is well defined, and is less likely to recur than is almost any other form of tumor. It seems a strange perversity of nature that most of the tumors in the cerebral hemispheres, where tumor is most accessible, are gliomata; and that most of the basal tumors, and therefore in regions of greater danger, are endotheliomata. Mallory regards the tumors commonly considered as fibromata or fibrosarcomata, as endotheliomata. These tumors occasion-

ally develop over the cerebral hemispheres, and the most successful surgical cases are those in which a growth of this character is found. Endothelioma may infiltrate the overlying bone, and the hæmorrhage then from the bone is severe when the bone is cut. A distinction should be made between a slowly growing and a rapidly growing endothelioma.

In the later stages of tumor the pressure at the base of the brain may cause partial obstruction of the ventricular cavities, and hydrocephalus. The symptoms then become so indistinct and indicative of a widespread lesion that a focal diagnosis may be impossible. The tumor often is so large at a late stage when operation is attempted that it can not be removed, or if removed the patient dies within a few hours after the operation, if not on the operating table. The pathologist too often finds a tumor that should have been removed and had remained undiagnosed, and on the other hand the surgeon sometimes removes an enormous tumor which from its character and situation should have given a favorable prognosis if permission for operation had been granted earlier.

It is not easy to explain certain signs of brain tumor. Failure of light reflex and bilateral exopthalmus have occurred in the writer's experience in tumor of the temporal lobe. Again we may see improvement in the condition of a patient who has a large tumor of the brain, especially if iodid has been given. Why this occurs we do not know. The tumor has not diminished in size, indeed it may have increased in size, and yet intelligence may take the place of stupor, and hopes are raised that soon perish. Seldom do periodic exacerbations occur in such an extraordinary manner as in the recent case reported by Rudolf and Mackenzie in which they seemed to be related to the menstrual period.

Wm. G. Spiller, M. D.

THE CHEMISTRY OF CELLULAR METABOLISM IN THE TOXÆMIA OF PREGNANCY

Toxæmia of pregnancy is a term that for many years has been applied by obstetricians to a symptom-complex characterized by nausea and vomiting, headâche, visual disturbances, delirium, and coma. With these have usually been associated albuminuria, with or without casts, and some degree of œdema. This group of symptoms has been regarded as taking origin in a more or less marked, if indefinite, systemic poisoning. In more recent years this term has broadened until to-day it includes hyperemesis, gravidarum and eclampsia. Incoercible vomiting is now looked upon as an exaggerated form of the emesis ordinarily thought of as physiologic, while eclampsia is spoken of as a toxæmia of the convulsive type. Indeed, Acconci has recently attempted to show, though not able to prove, that acute yellow atrophy of the liver is a consequence of a toxæmia due to pregnancy. Again, Rissman, in studying jaundice associated with pregnancy, has concluded that, while there is no jaundice peculiar to gestation, any changes in the liver in pregnancy accompanied with jaundice and toxæmic symptoms belong to eclampsia. The relation of puerperal insanity to intoxication was brought into question over two years ago by Huggins, recalling that as far back as 1857 Sir James Simpson showed that albuminuria appeared as a coincident with this mania in a large proportion of cases. Finally, in certain cases of septic infection there is reason to believe that even a mild toxæmia may so reduce the patient's resistance as to render febrile a puerperium that would have run an otherwise normal course.

Not only, then, do we find toxæmia expressed in protean forms, but as a result of wide clinical observation many teachers have come to agree with Bouchard that every pregnant woman

reveals, in some degree, evidence of auto-intoxication or toxæmia. Pathologically, the effort to divide these forms into two types, nephritic and hepatic, has not met with universal acceptance. This is due to the fact that, while the pathology has been fairly well worked out, the underlying etiological factors are as yet unrevealed. The kidney changes, varying from cloudy swelling to that appearance typical of nephritis, possess little significance, showing only one reason why the toxæmia of pregnancy bears so close a resemblance to that of uræmia. In the liver the changes are equally vague, ranging from a diffuse fatty degeneration, in mild cases, to acute yellow atrophy in fatal cases, or to typical miliary necrotic areas as in some cases of eclampsia. J. E. Welch has recently shown that these lesions are not uniform, either in mere toxæmia or in eclampsia, but he is quite certain that the hæmorrhagic areas are produced by liver and placental cell emboli, thrombi formed from blood plates and fused red blood cells and by a solution of vascular endothelium. Schmorl considers the necrotic areas in the liver as pathognomonic of eclampsia, the cell degeneration always being preceded by coagulation as a primary process. Hence there is some reason for upholding the view of Dienst, that fœtal blood, passing into the maternal circulation and acting there like blood from another species, produces various anti-bodies which are toxic and capable of producing coagulation in the maternal capillaries. Welch believes that the agent causing the hæmolysis and general cell destruction is most probably an enzyme.

Thus the study of the pathology of this complex condition has led every investigator in one direction, towards tissue metabolism and the chemistry of cell changes. Zweifel was the first of recent writers to insist upon this trend, though here, again, Simpson pointed the way in his generation. That the chemical side of this work was for so long a time neglected is due, no doubt, to the fact that obstetricians in the past have been interested more in the technical development of obstetrics, that chemical researches required a degree of technical knowledge not yet perfected, and that the changes in the urine and blood in toxæmia were supposedly analagous to those present in nephritis and uræmia. Thus for many years the kidney was regarded as the organ at fault in eclampsia.

However, following work on this subject by Gscheidlin, Spiegelberg, Voigt, Butte and Poehl, Zweifel and Zangemeister in 1904 first showed that in eclampsia a relatively high proportion of the total nitrogen took the form of ammonia salts. This increase was believed to be due to the presence in the blood of some acid in excess. Subsequently this acid was found to be lactic acid. Zweifel's reasons why convulsions are probably not due to this acid, however, are logical and his conclusions fall in line with those of Folin, whose work is most fundamental in the study of cellular metabolism. One can thus agree with Bouchard and Zweifel that the blood during pregnancy is toxic and necessarily, therefore, can regard the liver as essential in the elimination from the system of these poisons. Now, ammonia is chiefly produced in the alimentary canal, is rapidly increased with proteid digestion, and is converted into urea in the liver. Again, according to Folin, an excess of ammonia in the urine is merely an evidence of an acidosis and not of fault on the part of the liver. Since, as is well established, the total amount of nitrogen is entirely dependent upon the diet, it is only fair, so far, to say that a high ammonia co-efficient is more aptly coincident with a toxæmia than due to it.

On the other hand, the liver is an organ barely capable of performing its normal functions in ordinary health. Adding, therefore, to its burden of every-day metabolism the toxins

of pregnancy, it is but logical that the organ should undergo some degree of deterioration. In the milder toxæmias the nature of the damage done is indeterminable, but in patients dying of hyperemesis, eclampsia, and acute yellow atrophy the changes already referred to are present. That changes sufficient to interfere with normal function exist before necrosis occurs must be admitted.

Finally, more recent investigation by Ascoli, Weichardt and Veit, based upon previous deductions, has brought the research definitely into the laboratory of the chemist. The "placental theory" holds first place to-day in the etiology of the "convulsive type" of gestation toxæmia. Whether convulsions are produced when placental cells in maternal blood become too numerous for the syncytiolysins to overcome, or whether they are due to the syncytiolysins themselves, is an interesting problem. Weichardt may be right and the intoxication may be due, instead, to syncytiotoxins freed from placental cells by the action of the syncytiolysins. Yet no one of these theories is the most important thing. The real value of the work is that the solution of the toxæmia question is brought definitely within one line of research. This question in particular may seem to have become all the more complex to the obstetrician, but certainly only for a relatively short period of time. It is to physiologic chemistry that the internist and the surgeon are now turning over for solution their various problems of allied nature. CAREY CULBERTSON.

TRANSACTIONS OF SOCIETIES

CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD FEBRUARY 11, 1910, WITH THE PRESIDENT DR. ARTHUR DEAN BEVAN, IN THE CHAIR

DR. NORMAN KERR reported a case of "Growth of Bone against Resistance," and exhibited the patient. See page 396.

DISCUSSION

DR. ARTHUR DEAN BEVAN: I should like to say that this case interests me very much indeed. I have never seen one exactly like it. I have seen several cases where the fibula has been substittued for the tibia at some remote period in the history of the process. This, as I understand, was done pretty early.

DR. KERR: A month after the primary infection.

DR. BEVAN: I have seen two cases where the fibula was substituted for the tibia, but at a longer interval after the acute process. Dr. Kerr has obtained a most admirable result in this case and he has presented a plan which we can very well adopt in some of these cases.

I. CASE OF MISPLACED KIDNEY. II. INFECTION WITH THE BACILLUS ÆROGENES CAPSULATUS

BY S. C. PLUMMER, M. D.

I. CASE OF MISPLACED KIDNEY. J. B., aged 38 male. The patient complained of a swelling located in the region ordinarily occupied by the appendix vermiformis. After having been under treatment on the medical side of the hospital and discharged, he returned and insisted upon an operation to remove the tumor which he said caused him pain and total disability to perform manual labor.

The tumor was easily palpable and its resemblance in shape and consistency to a kidney was remarked. It was practically immovable. The nature of this mass was not determined, but it was thought most probably to be a displaced right kidney.

On October 13, 1909, an incision was made through the rectus muscle near its outer border and over the tumor, which was found to lie retroperitoneally and to the inner side of the ascending colon. The peritoneum over the tumor was incised and it was then seen that without doubt we had to deal with a kidney, whose lower portion lay on the brim of the pelvis.

An examination was now made as to the presence of other kidneys. Just above the misplaced kidney could be palpated, in the normal position on the right side, a kidney of normal shape, but larger than the average size. This proved later to be a normal kidney of large size. On the left side I thought I palpated a third kidney in normal position, but smaller than the average size. This proved later to have been an erroneous observation, as there was no third kidney.

Thinking, then, that I had to do with a supernumerary kidney, which caused pain and disability, and that the patient was amply provided with renal tissue without the kidney in question, I proceeded to remove it. The hilus was turned outward, that is toward the right side, and the vein and artery could be seen crossing the anterior surface of the kidney in a deep groove. The ureter passed directly downward from the hilus to the bladder. The vessels were ligated and the kidney removed. The posterior peritoneum was closed, and the incision in the abdominal wall closed without drainage.

Twelve hours after the operation, as the patient had passed no urine, a catheter was passed, but no urine found. Twenty-nine hours after the operation one drachm of urine was withdrawn by catheter. No more urine was passed until six full days after the operation when three ounces were voided. The following day he voided urine three times, amounting to five ounces in all. On each

of the two following days he passed a small amount of urine which was not measured. He died ten days after the operation, having passed not more than ten or twelve ounces of urine during that period.

During this time and up to within twenty-four hours of his death his general condition was remarkably good for a man who was passing practically no urine. Although at times emesis was frequent, he had periods when he retained considerable amounts of fluid by mouth. He also retained large quantities of normal salt solution per rectum, sweet spirits of nitre, caffeine, and potassium citrate were administered. The bowels moved well.

Three days after the operation a slight bloody discharge was noticed on the dressings, one stitch was removed and a small gauze drain inserted into the subcutaneous space. The discharge was tested for urea, but none found.

Five days after the operation a small portion of omentum protruded through the wound. The dressings had a urinous odor and were found to contain considerable urea.

Seven days after the operation a considerable amount of urea was again found in the discharge, as well as a large quantity of albumen.

Nine days after the operation a loop of intestine protruded; upon replacing this eight or ten ounces of fluid escaped, which was clear and sticky and had the odor of urine. The intestinal loop was retained by a gauze pad, covered with a strip of adhesive plaster.

The patient died ten days after the operation.

II. Infection with Bacillus Ærogenes Capsulatus. Case 1. C. J., aged 45, male. On October 23, 1909, while at work wrecking a hotel building, he was struck across the left thigh by a heavy iron beam, which fell from a considerable height. He sustained a compound comminuted fracture of the femur, accompanied by a large open wound through which could be seen extensive laceration and contusion of the heavy muscles of the thigh. Clothing and dirt had been carried deeply into the wound.

He was said to have lost much blood and was in rather profound shock. Pulse 70. Temperature 97.8.

The wound was cleansed as thoroughly as possible without the administration of an anæsthetic, and was packed with gauze wet with a 1-2000 formalin solution, without any attempt at closure, but rather with the intention of keeping it as widely open as possible. Long side splints with extension were applied.

Fifteen hundred units of antitetanic serum were administered and appropriate treatment for shock instituted.

The pulse and temperature gradually rose, so that twelve hours after the injury the pulse was 88 and the temperature 100.6; twenty-four hours after the injury pulse 98, temperature 102.8; forty-eight hours after pulse 120, temperature 101.8; during this time the patient had suffered from frequent emesis.

Forty-eight hours after the injury the interne upon changing the dressing found emphysema in the tissues adjacent to the wound, with a strong odor of decaying flesh. Nine hours later, or fifty-seven hours after the injury, I performed an amputation at the hip-joint by Wyeth's method. By this time the emphysema had extended so high that part of the incision had to be made through emphysematous tissue. The patient lost but little blood. The wound was left wide open and packed with gauze wet with seventy per cent alcohol. There was no appreciable shock, but 500 cc. of normal salt solution was given hypodermically while the patient was on the operating table.

As soon after the operation as the necessary preparation could be made the subcutaneous tissues adjacent to the operative field were injected with a supersaturated solution of salicylic acid in warm alcohol, as recommended by Dr. L. L. McArthur.

Just prior to the operation the pulse was 140 and the temperature 101.6.

For a time following the amputation the patient's general condition improved, the pulse and temperature gradually falling until nineteen hours later the pulse was 108 and the temperature 98.6. The emphysema gradually spread on to the trunk.

Suddenly, however, there was a change for the worse, the pulse becoming rapid and weak accompanied by delirium. The patient died twenty-seven hours after the amputation, eighty-four hours after the receipt of his injury.

Case 2. Male, aged 51, Chinese. This case was in the service of Dr. John E. Owens.

On December 19, 1909, at 4:30 P. M., the patient was admitted into the hospital with a gunshot wound through the calf of the right leg. The bullet passed through the muscles from before backward without striking either of the bones. The wounds, two small round openings, were cleaned and a sterile dressing applied.

His temperature on admittance was 99.2, pulse 88, and respiration 22. The pulse, temperature, and respiration remained about the same until noon the next day.

On the morning (December 20th) the skin

around the wound was discolored and gave out a thin, foul-smelling, bloody discharge. The patient's general condition seemed good. He smoked and talked with his friends.

About noon that day (December 20th) his pulse and temperature began to rise reaching 101.4 and 88 at midnight.

On the morning of the 21st his temperature was 100, and pulse 96. He suffered considerable pain but was conscious and his general condition seemed good. The leg by this time was discolored to about three inches above the knee, swollen, and emphysematous. There was a very foul odor of decaying flesh and some discharge from the wound.

He was given an anæsthetic at 3:00 P. M., and the leg widely opened by longitudinal incisions, alcohol dressings applied, and a strong solution of salicylic acid injected above the line of emphysema.

The temperature, pulse, and respiration were at 5:00 P. M., 101.8, 132, and 32. The temperature, pulse, and respiration gradually rose from that time, until at 9:00 P. M. the temperature was 102.8. This is the last temperature recorded. The pulse was 160 and respiration 44 at 12 midnight.

He had profuse emesis and became delirious at about 9:00 that evening, it being necessary to put him in restraint. He died at 12:40 A. M.

For the bacteriological findings that follow I am indebted to Dr. Guy of the resident staff of St. Luke's Hospital, which is as follows:

Cover glass preparation made from the sanious discharge contain a large bacillus, retaining the stain by Gram's method, capsulated, and sometimes showing a somewhat granular appearance. The bacillus is arranged in pairs, singly and sometimes in short chains. The free ends of the bacillus are round, but where two or more are joined the ends are square. Hanging drop shows a non-motile bacillus.

Culturally it is a facultative anærobe.

In milk which is the most characteristic, coagulation takes place rapidly, gas is very abundantly formed, the curd being riddled by the fermentation. The whey is clear and gas bubbles are seen clinging to the ragged curd. Litmus is turned red at first, but is soon decolorized.

Agar stout tubes show small colonies varying from pin point to pin head, white insert raised above the surface, and having regular edges. There is gas found in the bottom of the tube.

In blood agar growth is luxurious, hæmoglobin taking place and abundant gas formation.

Blood agar plates show small colonies, round white, pin head in size, surrounded by a hæmolytic zone. Dark colonies are usually marked by a bubble of gas. In old blood cultures there is a putrefactive odor.

Cultures were injected intravenously into a small kitten which was killed soon after and placed in an incubator. In twelve hours the cat was swelled to twice normal size by an inflammable gas.

The liver and spleen were foamy and showed on staining enormous numbers of the bacillus. Cover glass preparations showed a bacillus corresponding exactly to the one found in the bloody exudates.

Culturally it gave the same reaction.

The cultural characteristic and morphology of the organism found in case No. 2 correspond exactly to case No. 1.

DISCUSSION

DR. DANIEL N. EISENDRATH: I was very much interested in the first case reported by Dr. Plummer for the reason I think we are just beginning to appreciate the relative frequency of congenital anomalies of the kidney. Amongst the congenital anomalies of the kidney I include three — the variety shown by Dr. Plummer, which is the congenital displacement of the kidney, and the one congenital hypoplasia, and congenital malformation or anomalies in the blood-vessels of the kidney.

During the past winter my assistant, Dr. Strauss, and myself have been dissecting many cadavers, and it is remarkable with what frequency one finds these anomalies of the kidneys. So far, in about thirty cadavers, we have found one typical case of the so-called hypoplasia, a specimen of which I intended to have brought here this evening, in which one kidney is of the size of a small marble and the other kidney is comparatively normal in size. I have encountered such a case and reported it about three years ago in the Annals of Surgery, which caused a blocking up of the healthy kidney, producing complete anuria. The other kidney, the hypoplastic kidney, was not able to do any work thrown upon it through the blocking of the healthy kidney.

In regard to the condition which has been described by Dr. Plummer of dystocia, I recently have seen two cases of this kind. One of them was operated on by Dr. Kammerer in the German Hospital, New York. The patient complained of pain located over the sacrum, located between the umbilicus and symphysis pubis, and in the right side of the abdomen a distinct tumor could be palpated. I happened to be present when the abdomen was opened, and it was found the tumor with the kidney lay retroperitoneally over the sacral

promontory. The kidney was not removed in that case.

The second case was one in which the dystocic kidney caused a very serious obstruction to labor. I saw in the Hamburg General Hospital on the autopsy table an unusual kidney which had become wedged in between the uterus and the promontory of the sacrum and had caused dystocia.

As regards the anomalies of the kidney to which Dr. Plummer has called our attention in these specimens from Dr. Le Count's Museum in Rush Medical College, it is considerable of a surprise when you come to examine a number of cadavers to find the frequency with which these anomalies occur. Seldowitsch, who has examined one hundred and ten cadavers found that these anomalies of the arteries occurred in about thirty per cent of the cadavers. In our statistics so far we have only examined about thirty cadavers and found anomalies in fully fifty per cent. Of course, we cannot draw any definite conclusion from such a small number, but I do not think we, as surgeons, in general, give enough attention or attach importance enough to the value of these anomalies. We find, for instance, that this variety which Dr. Plummer has shown in these specimens is one of the most frequent ones in which there are two separate arteries arising from the aorta and running to the hilus of the kidney. These two arteries may rise from the aorta close together, or they may be two or three inches apart. Then there is another anomaly that is of the utmost importance, and that is, in which there are two separate arteries. This specimen shows two separate arteries given off from the aorta running to the upper pole and to the hilus, the one running to the upper pole being larger than the one running to the hilus. One of our specimens shows an artery running to the lower pole about the size of a goose quill, running from the iliac after leaving the aorta.

I think the case which Dr. Plummer has reported is exceedingly interesting and important.

Dr. L. L. McArthur: I have recently had come to me again a case which I referred to this society in connection with misplaced kidneys. It was the case of a young girl, nineteen years of age, with a tumor opposite the promontory of the sacrum that was tender, painful, which gave no shadow with the X-ray, although it gave many of the characteristics of a tumor of the bony pelvic wall, and which on exploration proved to be a horseshoe kidney with its arterial supply from the common iliac vessel. Being a horseshoe kidney and double, it was impossible of removal. Not having had permission from the girl to interfere with possible future pregnancies, I was obliged to close the abdomen. When she recovered, the parents and the girl were informed of the danger of letting this condition remain because each segment of the horseshoe reaching well down into the pelvis might be compressed by the uterus.

Two months ago she came to my office six or seven months advanced in pregnancy, and again refused to have any interference with the pregnancy. I do not know what the ultimate outcome will be in her case, but I think she is in great jeopardy. I communicated with her family physician and acquainted him with her condition.

I am particularly interested in the emphysema produced by the organism Dr. Plummer has described, because I had three successful cases by the simple injection of multiple doses of salicylic acid, a drop at a time, in the periphery of the advancing disease, checking the disease, and the gangrene becoming localized. The soft tissues sloughed off only so far as the wall of salicylic acid which was put as a barrier between the advancing organisms. After operating on a case of carcinoma of the pancreas involving the common duct and producing icterus, making an anastomosis between the gall-bladder and the duodenum, I was unfortunate enough to have a case of acute invasion of the liver by the bacillus capsulatus ærogenes, the infection seeming to have spread from the contents of the intestine or bile tract to the liver, because there was no evidence at any time of peritonitis, and a post-mortem examination showed union between the gall-bladder and duodenum to be all right and to have remained perfect. The liver on section after death presented the appearance of a sponge. On section it resembled more lung tissue than liver tissue.

Dr. H. M. Richter: About two years ago a patient was brought into the Wesley Hospital with a compound fracture of the lower part of the leg, and he was treated in the usual manner with ordinary scrubbing and external antisepsis. We did not use any iodin or carbolic acid or any of those agents. One morning at nine o'clock it was noticed that a gangrenous area had formed around the open wound and emphysema showed itself over quite an area. The patient refused operation at that time and it was eight hours later before consent of the patient was obtained to amputate. At that time the gangrene had reached two or three inches above the knee-joint and the emphysema had extended up the thigh and onto the buttocks, and up into the abdomen. If a thigh amputation is called for with the idea of getting rid of infection, it seems to me in such a case a thigh amputation would be contraindicated, because, of course, it would be quite impossible to get above

the area of infection. I made a high amputation and in order to relieve tension in the tissues above the line of amputation I made longitudinal slits well up into the buttocks and level of the pelvis in front, the slits extending through the skin and fascia with the idea of relieving tension and for no other purpose. This patient, like the case reported by Dr. Plummer, showed no evidence of intense sepsis. That is to say, these patients do not die from the infective process, but from mechanical complications. The outcome in this case tended to prove definitely, and as a matter of experimental evidence would prove it, that with the infection extending above the line of incision the patient is safe if pressure is relieved. This patient recovered.

DR. ARTHUR DEAN BEVAN: With reference to the first case, I desire to state that I have recently had the opportunity of operating upon a somewhat similar case of misplaced kidney such as Dr. Plummer has presented to you. It was rather interesting. The man was operated on by a well qualified surgeon four or five years before for a tumor almost in the median line, or a little to the right of the median line just below the umbilicus. This tumor was painful; it could be outlined and felt and it had caused severe attacks of pain, which lasted for hours or some days. The surgeon, a well-known operator, made a midline incision, and came down upon a retroperitoneal mass which he thought was probably the kidney, or a horseshoe kidney. The operation was exploratory. He closed the wound and the patient went on to recovery from the operation, but the old trouble remained. About six months ago he came to Dr. Billings, who had the urine examined carefully and found pus and blood in it. An X-ray examination disclosed a stone in front of the promontory of the sacrum. We then had the ureters catheterized; the catheter that went into the right ureter made a short curve about three inches long, while the one in the left ureter went into the entire length of the normal kidney pelvis. The X-ray is a beautiful example of work of this kind. An X-ray was taken with the catheter *in situ*. It proved definitely the presence of stone in the misplaced right kidney. The question was how to remove it, whether a midline incision should be made, and whether the transperitoneal or retroperitoneal route should be adopted. As a matter of fact we decided upon the retroperitoneal route, and it was simplicity itself. A muscle-splitting incision, such as weu se for an appendix operation, was made, and then enlarged by stretching and with no difficulty at all one could reach, after stripping back the peritoneum and not going into the peritoneal cavity, the pelvis of the kidney. Pyelotomy was made and the stone removed from the pelvis and ureter. Drainage was simple. A cigarette drain was inserted down to the point, no attempt was made to close the opening in the pelvis, because of the considerable depth of the wound and the difficulty of such a procedure. The patient went on to an uninterrupted recovery. The kidney was not removed because it seemed to contain a great deal of normal kidney tissue.

I want to say a word or two in regard to gas bacillus infection. We had, some time ago, a case of gas bacillus infection in our service; a boy had his arm caught and wrapped around a rather small machinery shaft. Every time the arm would go around the shaft it would break the bones every two or three inches so that there were multiple fractures from the wrist to the shoulder. We made an effort to save the arm. The radial artery was intact and the radial pulse could be felt; the ulnar pulse could be felt. On that account we scrubbed up the arm and attempted to save it. There was very little injury to the skin. At the end of the second day gas bacillus infection occurred and spread rapidly up the arm, so that a shoulder-joint amputation was made above the point of emphysema, and the patient went on to recovery without any complications.

DR. PLUMMER (closing the discussion): The fact of interference with parturition by a misplaced kidney was mentioned. In the small specimen where the kidney lay in the small pelvis, apparently, such a difficulty might have been met with if pregnancy occurred. I do not know whether that kidney came from a man or a woman, but in the female pelvis it might have interfered with delivery.

There is a recent article by Dr. Oscar Meyer, published in 1908 in the Beiträge zur Pathologischen Anatomie und zur Allgemeinen Pathologie, Ziegler, vol. 44, page 1, in which he gives a detailed description of a dozen or more of these cases of malposition of the kidney, and also of horseshoe kidney, and the interesting question is brought up in regard to the anomalies of the renal vessels. The question is whether a kidney is misplaced because the vessels originate from an abnormal location, or do the vessels which originate from an abnormal location accommodate themselves to a kidney which was originally misplaced? One thing I noticed in my specimen, as in all Meyer's diagrams, the adrenals stay in the normal position. No matter how far from the normal position the kidney may be the adrenals you will find where they belong.

DR. ALEXANDER HUGH FERGUSON read a paper entitled, "Carcinoma of the Pancreas." (See p. 393.)

DISCUSSION

DR. ARTHUR DEAN BEVAN: I am sure that all of us have been very much interested in the subject of pancreatic lesions in the last few years. There is no doubt they are very much more common than we formerly believed. There is one point that has seemed to me of great importance in this connection, namely, the differential diagnosis between malignant disease and chronic interstitial pancreatitis. I was in hopes that Dr. Ferguson would possibly offer some suggestion along this line. I have seen and operated on about a dozen cases of carcinoma of the pancreas, and about the same number of cases of chronic interstitial pancreatitis. I have never been able to obtain clinical evidence which would enable me to make a differential diagnosis between the two affections. I remember one winter when I was on the service of the Presbyterian Hospital we had six cases of supposed carcinoma of the pancreas, and our attention was thu specially called to the subject. I made exploratory operations on these patients. In two of the cases where we found a large hard mass in the pancreas, and I gave the opinion that it was carcinoma, I gave a hopeless prognosis. One case I drained externally, and in the other case we did a cholecystenterostomy. Both of these patients went home and proceeded to recover entirely and to discredit my diagnosis, and they were evidently cases of chronic interstitial pancreatitis.

Yesterday I operated on an old lady with a long history of gall-stone disease. The gall-bladder was impacted with stones and a hard, firm mass could be felt in the pancreas. I could not say whether it is carcinoma or chronic pancreatitis. Now to my mind this is one of the most important points that confront us as surgeons to-day, namely, how to make the differentiation between the two diseases. I am free to confess that I have no knowledge which will enable me to say in a case of that kind whether I have to deal with carcinoma of the pancreas, or with chronic interstititial pancreatitis. It is dangerous to remove a section of the pancreatic mass for histologic examination on account of the dangers of necrosis and hæmorrhage. I am rather of the opinion that we should give all these cases of hard swellings in the pancreas the benefit of the doubt and institute wherever possible drainage, and of late I have been much in favor of cholecystenterostomy rather than cholecystostomy. If the patient's condition is fairly good I should prefer cholecystenterostomy, because the patients are much more comfortable after cholecystenterostomy than after cholecystostomy. I now make the operation with suture. We are all in the position to-day where we long for some blood test or some other form of easily employed means of diagnosis to make this differentiation between carcinoma and chronic inflammatory processes not only of the pancreas but in many other locations.

DR. MAURICE I. ROSENTHAL, Fort Wayne, Indiana: I have quite recently had some experience in the treatment of these cases of malignant disease of the pancreas and have met with difficulties along the lines laid down by your president, Dr. Bevan. The early diagnosis of cancer of the pancreas is not easy, notwithstanding the more recent laboratory investigations, so that at the present time cancer of the pancreas resolves itself into a differentiation between that disease and disease of other neighboring organs, or inflammatory disease of the pancreas itself. I have one old lady whom I see occasionally, and upon whom I operated some ten years ago or more, and in this case I made an unfavorable prognosis, mistaking inflammatory for malignant disease. This old lady, whenever she sees me says, "Doctor, I am still alive."

We were dealing with an inflammatory tumor of the head of the pancreas, which, because of its hardness, its evident infiltrating character, its nodular feel and contour, and because of its having evidently produced metastatic involvement of neighboring glandular structures, we felt justified after opening the abdomen, in making an unfavorable prognosis. After opening the abdomen we found an atrophic gall-bladder and drained it for the purpose of relieving the cholemia. The patient permanently recovered. Since then I have removed and examined metastatic glands in cases in which I have suspected malignant disease of the pancreas, and these apparently carcinomatous glands have frequently proven to be inflammatory in character. When we open the abdomen in these cases we find such difficulties as Dr. Bevan has stated.

A second case which possibly illustrates some diagnostic features of this disease is one which I remember very well, referred by Dr. Cook of Bluffton. This woman was brought in with some jaundice. There was no history of biliary colic, but there was evident a palpable distended gall-bladder. The gall-bladder was in its proper position, just where you would expect it, under the liver. Pressure on the gall-bladder elicited no pain whatsoever. We immediately suspected and stated that there was a malignant condition of the gall-bladder, and that this was not a case of gall-stones.

This (the gall-bladder) is one of the places where malignancy is not painful on pressure. This is

frequently true of malignancy in the head of the pancreas itself. This case proved to be one of malignant disease of the head of the pancreas, and between the head of the pancreas and the liver there lay a collapsed and compressed gall-bladder.

One woman, who left the hospital day before yesterday, was brought in with extreme jaundice, with a very large liver, and under this liver, presenting below the umbilicus was a distinctly palpable gall-bladder. This gall-bladder was not painful on pressure, and here again, on this account we suspected malignancy. We could feel no tumor of the pancreas, but on opening the abdomen the pancreas was found enlarged and evidently malignant. There was a hard, nodular mass infiltrating the neighboring organs, and I do not doubt that this case is one of malignant tumor of the pancreas. We made a cholecystenterostomy at the upper end of the ascending colon, because here I think we have an area of lesser bacterial activity. This woman left the hospital a few days ago. Her cholemia is disappearing. For the reason that this tumor produced no pain on pressure, knowing that the cholemia came on gradually, and that we had a distended gall-bladder, in the absence of stone I felt secure in the diagnosis that we had a malignant tumor to deal with.

This subject is becoming more and more interesting to us in a surgical way, but we can hope for very little, so long as the early diagnosis of malignant growth in the pancreas remains an impossibility.

Dr. Ferguson (closing the discussion): The only new thing that has been brought forward in the way of differential diagnosis is the work of Cammidge, who maintains that in inflammation of the pancreas there are certain crystals, while in carcinoma there are no crystals. Of course, we can bring out the various symptoms and signs of disease of the pancreas, but I think this special case is interesting, both from a clinical and pathological standpoint, as showing an exception to Courvoisier's law.

Dr. L. L. McArthur read a paper entitled, "A Communication Regarding a Modification of the Technique in Suprapubic Prostatectomy." (See p. 412.)

CHICAGO GYNECOLOGICAL SOCIETY

Regular Meeting Held January 21, 1910, with the President, Dr. Charles B. Reed, in the Chair

HERBERT MARION STOWE, M. D., Editor

I. CASE OF INCOMPLETE UTERINE RUPTURE FOLLOWING KRISTELLER EXPRESSIONS DURING DELIVERY; RECOVERY. II. CASE OF UTERINE RUPTURE AT TERM PRODUCED BY THE KARL BRAUN CRANIOCLAST; PROLAPSE OF INTESTINE INTO UTERUS; EXPECTANT TREATMENT; RECOVERY. III. CASE OF PNEUMOCOCCIC INFECTION IN THE PUERPERIUM, PLEURITIS, LOBULAR PNEUMONIA, AND PERICARDITIS; PULMONARY ABSCESS; RECOVERY

By HERBERT MARION STOWE, M. D.

Case 1. Mrs. S., age 30, para 3. Family and personal history negative. The first labor in January, 1907, was normal and recovery was complete. In April, 1908, she miscarried at three months. The following day, a physician curetted the uterus to remove some retained decidua. During the operation, the uterus was perforated in the left wall. Following this accident, the patient suffered from fever, vomiting, chills, and pain in the abdomen for nearly two weeks, and she gave a typical history of pelvic peritonitis. On July 16, 1909, her second labor began and she called a midwife to attend her. The first stage was normal but the uterine contractions became weak and progress was slow when the head had descended to the pelvic outlet. The head was

visible for a period of over two hours. The midwife now attempted Kristeller expressions to assist delivery and later explained that she applied the thumbs over the fundus and the fingers along the sides of the uterus and pressed in the direction of the inlet. Most of the pressure was applied laterally. During the third attempt, the woman suddenly cried out with pain and the pulse became rapid and weak. No further expressions were made.

Upon my arrival, one hour later, the patient appeared somewhat shocked. Pulse 120 and weak. The abdomen was tender to pressure and the patient complained of sharp pain on pressure over the left iliac fossa. No emphysema was present but an ill defined resistance was made out at this point. No heart tones were audible. The pelvic measurements were normal and the perineum was relaxed from an old laceration. The fœtal head was flexed and the occiput lay anterior. I delivered the fœtus easily with forceps, using not over ten pounds of traction. It was dead and weighed seven pounds and four ounces. An examination of the uterine cavity disclosed a laceration in the left wall, eight centimeters in length, beginning just above the vaginal fornix and extending upward and slightly posterior. The rupture was incomplete and was completely closed in by the tissues of the broad ligament. The rent was filled with a blood clot.

This tear was packed with lysol gauze and the uterovaginal tract firmly tamponed. Externally, the portion of gauze packed in the broad ligament was clearly palpable. This tampon was removed on the next day. The patient soon recovered from her shock and the pulse became normal on the fourth day. She was given ergot and hydrastis, placed in Fowler's position, and the lower abdomen was covered with ice bags. She left her bed in three weeks and since has recovered perfectly.

It is possible that the pressure exerted by the midwife over the left uterine wall was the direct cause of the rupture, but undoubtedly the previous injury constituted the primary factor. According to Gans and Eisenstein, previous uterine perforation is a significant factor in the etiology of many cases of spontaneous or hysterogenetic rupture at full term. Previous curettements with a sharp curette or gynecological operations on the uterine body constitute important data in the obstetric history of every pregnant woman.

Kristeller expressions are generally considered to be devoid of danger. When properly performed, they are of great assistance in labor. Care should be taken, however, to avoid pressure on the adnexa. Several cases have been reported where ovarian and tubal abscesses have been ruptured by this lateral compression. Lieber reported in 1909 a similar case of uterine rupture due to a midwife assisting delivery with technically incorrect Kristeller expressions. The woman went into immediate collapse and the fœtus passed into the peritoneal cavity. The abdomen was opened but death occurred on the operating table. No previous history of uterine injury was obtained.

CASE 2. Mrs. G., age 27, para 1. Polish housewife. The patient had been in labor for fifteen hours and several attempts had been made to deliver her at home but to no avail. She was sent to the Cook County Hospital on June 16, 1909. The patient was well nourished but anæmic. Her pulse was 126 and weak. Temperature 100.8° F. She had the appearance of one who had just passed through an operation. The pelvic measurements were IS, 21; IC, 23; BiT, 29; Baud, 18; CD, 11.5 and CV, 9 cm. The pelvis was of the flat generally contracted, non-funnel shaped variety. The fœtus presented by the head in the occipito-læva-transverse position. It lay above the inlet and was movable. The funis had prolapsed and was pulseless. No threatened rupture of the uterus was determined. Craniotomy was the operation of election. The head was perforated and the Karl Braun cranioclast applied to it by the interne. The external blade was passed somewhat posteriorly. The blades failed to lock and as they were withdrawn, a coil of intestine was palpable within the cervix.

Upon examination, a circular rupture was discovered about ten centimeters above the external os uteri in the posterior wall. It was possible to pass three fingers through the opening. The bowel had not been separated from its mesentery as far as one could determine by palpation. At this time the mother's pulse became almost imperceptible and the cyanosis was so marked that the anæsthetic — ether — was withdrawn. The poor condition of the patient, the shock, cyanosis, pulse (160) and the probability of infection in the previous operations indicated the expectant line of treatment. It was deemed safer to trust to the danger of intrapelvic delivery and sepsis from the prolapsed intestine than to resort to laparotomy and probably the Porro operation.

The intestine was, therefore, replaced and a second attempt made to apply the Braun cranioclast but it failed to hold. The cranial vault had been so injured by the previous operations that it was impossible to secure a firm hold. If the three-bladed cranioclast of Auvard had been accessible, I believe that I could have finished the delivery.

Notwithstanding the danger of version after craniotomy, the patient's condition demanded an immediate delivery and podalic version and extraction offered the quickest method. Several loosened fragments of bone were removed and a foot brought down with moderate difficulty. The after coming head was crushed and easily extracted. The child weighed seven pounds. The placenta was removed at once, and the bowel found to be slightly prolapsed through the rent. No further injury to the uterine wall was discovered. The bowel was replaced and the rent and uterovaginal tract tamponed with iodoform gauze.

The woman was placed in Fowler's position, given small doses of ergot and hydrastis and ice bags applied to the abdomen. The bowels moved spontaneously on the second day and the stools contained blood clots. The passages were bloody for several days. The patient complained of severe cramps in the limbs and pain in the lower abdomen. The hypogastrium was painful to deep pressure. Nausea was present on several occasions but no vomiting occurred. Moderate tympany. These signs were undoubtedly due to a localized plastic peritonitis. The pulse and temperature gradually fell and became normal on the tenth day. The uterus was packed three times for a period of two days each.

Mrs. G. left the hospital on the thirteenth day of the puerperium against medical advice. I saw her in November, 1909, and found the uterus in the first degree of retroversion. The uterus was movable but was moderately painful on pressure. Otherwise, her recovery was satisfactory.

Case 3. Mrs. L., age 41, Russian Jewess. Both family and personal history are negative. She is the mother of twelve children. The labors were normal. No history of puerperal infection. She was taken in labor with her thirteenth child on August 6, 1908, and was under the care of the Outdoor Department of the Chicago Lying-In Hospital. The first stage was tedious and lasted nearly twenty hours. At this time she entered the service of Wesley Hospital. The patient was a strong and muscular woman in good condition. Pulse 90, temperature 99°F. The abdomen was pendulous and the diastasis between the recti was marked. The fœtal head lay in a position of right deep transverse arrest. During the second stage the fœtal heart tones became rapid and irregular and the child was delivered with forceps. There were no lacerations of the soft parts. The child was slightly asphyxiated but was easily revived. The patient was carried back to bed in good condition. A slight cough had been present for a week but no bronchitis.

Several days following delivery the patient complained of a sharp pain in the left thigh and leg suggestive of a phlegmasia alba dolens but no thrombosed veins could be palpated at any time nor was there any sign of lymphangitis. The involution of the uterus was normal and the fundus sank below the plane of the inlet on the ninth day of the puerperium. The breasts and nipples were negative. There was no evidence of inflammation or infection in the abdomen or pelvis at any time. The generative organs appeared to be normal in every way.

On August 11th, the patient began to perspire freely. A sharp pleuritic pain developed in the right chest. Upon finding evidence of fluid, three ounces were withdrawn by an aspirator but the laboratory findings were negative. On the following day lobular pneumonia was diagnosed by Drs. A. Davis and C. A. Elliott, who kindly examined the patient. From August 12th to the 17th, the temperature rose gradually and the pulse respirations increased in frequency. At eight o'clock in the evening, the patient suddenly collapsed, became markedly cyanotic, and was extremely prostrated. The dypsnœa was extreme. It was necessary to prop up the woman in bed and administer oxygen. The respirations quickly rose from 30 to 50 a minute. The temperature dropped to 96° (rectal) and then rose to 103.6°F. The pulse rose from 100 to 140 and became very irregular. A pericardial friction sound was heard over the rightside of the heart, being synchronous with the cardiac action. Under energetic stimulation, the condition improved materially. The following day the pericardial friction sounds became less audible and soon disappeared. The pulse was still irregular and weak. The diagnosis was confirmed by Dr. N. S. Davis. The cough now increased in frequency and expectoration became more profuse. An area of dullness gradually developed near the junction of the upper and lower lobes of the left lung posteriorly and on September 4th an abscess ruptured into the bronchi and a large amount of pus was expectorated. Following the rupture of the abscess, the dullness disappeared. The condition improved and the patient left the hospital on September 13th. One month later she claimed to be perfectly well.

The urinary findings were negative except for a trace of albumen. A culture of the blood was negative. Pneumococci were found in both the cervical secretion and the sputum.

The treatment consisted in the administration of strychnine and digalen for the heart, ice bags for the pericarditis, and later ammonia carbonate to promote the expectoration.

DISCUSSION

DR. GEORGE SCHMAUCH: These cases are very interesting. In regard to the first case, it looks to me very improbable that perforation of the uterus by the curette could have occurred so low down in the uterus. Generally, such perforations occur high up in the fundus. I am a great friend of the Kristeller method of expression, and I have never seen any bad consequences from it, although such cases have been reported.

In regard to the second case, I would like to say that the Braun's cranioclast never should be applied over the occiput. It will not hold. The outer branch always should be placed over the face. It is the only way to take hold. If you place the cranioclast over the occiput, you either tear out the occiput or the cranioclast will come away.

The Kristeller method of expression was devised to replace the pressure of the abdominal wall, so that the only time to use it is during the last stage of labor, when the head is on the pelvic floor. Every obstetrician who uses scopolamin is forced to use this method, especially in primipara. You cannot make them help you when under the influence of scopolamin, because you cannot rouse the woman sufficiently to use her abdominal muscles as she should. As long as the head is above the pelvis, we use Mueller's method, because the Kristeller method is not to be used until the head is down on the pelvic floor.

DR. G. KOLISCHER: It is true that the curette usually perforates the uterus high up, but as a rule the perforation is started by the instrument that is used for the dilation of the cervix, so that the hole is low down into the broad ligament.

As to the application of the expression method. Often we find that the uterus is squeezed to express its contents, but the object of the Kristeller method is to try and force the head out of the outlet by using the breech of the patient as a lever. We do not squeeze the uterus, but press the fœtus down. Thus, the uterus can neither be lacerated nor torn.

DR. J. CLARENCE WEBSTER read a paper entitled "Mistakes in Diagnosis Relative to the Urinary Tract in Females." (See p. 399.)

DISCUSSION

DR. T. J. WATKINS: Dr. Webster's bladder cases remind me of a case recently under my observation. The chief symptom was a burning pain in the region of the bladder. The patient's physician considered her neurasthenic. On examination I found a small cystocele and a somewhat relaxed perineum. I was inclined to regard the patient as being neurotic, and the burning sensation as imaginary. The urine contained a few white cells, but was otherwise negative. Cystoscopic examination disclosed a number of small capillary hæmorrhages in the mucous membrane of the bladder. The residual urine was rather large in amount and the patient was in the habit of straining and had a constant desire to urinate. Undoubtedly, this straining produced the capillary hæmorrhages which in turn caused the burning sensation. The cystocele was repaired, the perineum was strengthened, the bladder was irrigated two or three times, and at the last cystoscopic examination the hæmorrhagic spots had almost entirely disappeared.

One cannot take exception to much, if anything, Dr. Webster said. I disagree with him in one respect, however, and that is that bladder symptoms are often due to traction and pressure on the bladder. One frequently sees cases where it is claimed that the bladder symptoms are caused by anteflexion of the uterus. As a student of Emmet, I saw many cases of bladder pain caused by pulling of the uterosacral ligament on the bladder. Then we would see cases of large tumors where there was apparently no space for the bladder, and yet there were no bladder symptoms. In cases of procidentia, where most of the bladder is outside of the body, there frequently are no bladder symptoms. All of which makes one believe that pressure and traction on the bladder are not often a cause of bladder symptoms. I have studied this question for many years, and it seems to me that practically all of these cases are cases of chronic infection of the bladder, usually gonorrhœal.

The point of palpating the lower end of the ureters to determine the presence of tenderness and comparing one side with the other is of extreme importance. If the tenderness is greater on one side than on the other, then one should be almost certain of ureter trouble.

I have seen cases of hysterical retention of urine. I would have them go to a hospital, instruct the nurses and internes to say nothing to them about their retention of urine, and even refuse to catheterize. There is not much danger of rupture of the bladder, because the patient will empty it when it is full. Not long ago a patient went to the hospital who had been catheterized for two or three months. The internes and nurses were instructed to pay no attention to the bladder. At the end of a week she went home cured. Her bladder at no time was admitted as a topic for conversation.

As to stomach symptoms and prolapse of the kidney. I recall the case of a woman who had much stomach disturbance. Stomach analysis was negative. One day the interne told me that she had

a prolapsed left kidney. I examined the patient in various positions, but failed to find the prolapsed kidney. Two or three days afterward the interne told me that he had found it again; still I could not find it. One day when she had much pain I examined her and found a prolapsed left kidney. The lower pole was some distance below the line of the anterior superior spine of the ilium. The kidney was stitched up and the stomach symptoms disappeared. I am sure that the reason I could not find the kidney at first was that the woman held the abdominal muscles so rigid as to hold the kidney in place. I might have found it if I had had her anæsthetized.

The long right lobe of the liver was an interesting point, and it suggests the value of a careful examination of all these cases of enlargement in the region of the gall-bladder and kidney by auscultatory percussion. I believe that one can by that means always differentiate between enlarged liver and tumor of the kidney. I saw a case with Dr. Danforth, in which auscultatory percussion disclosed a long right lobe of the liver, the diagnosis being confirmed by exploratory incision.

There are two or three points that I bear in mind in the diagnosis of a prolapsed kidney. One is to inquire on which side the patient lies. With a right prolapsed kidney the patient always invariably sleeps on the right side; the contrary is true when the left kidney is prolapsed. Then determine whether the pain is relieved by lying down, as is the case in a prolapsed kidney. Then, the pain is always described as a pulling sensation underneath the ribs. Not many diseases produce that kind of a pain.

DR. GUSTAV KOLISCHER: The majority of physicians insist on treating every woman who complains of disturbance in or near her urinary organs by bladder irrigation, without making an examination. No treatment of cystitis should be begun or continued without cystoscopic examination. The complaint of pain in the bladder should always arouse a suspicion of kidney disease. Often, frequency of urination may be the first symptom of tuberculosis of the kidney, and thus we might miss the best time for operating if we proceed to irrigate the bladder without making a diagnosis. One can almost say positively that there is no condition of the kidney that cannot be diagnosed by cystoscopic examination. There are always changes around the ureteral opening, a gaping or pouting, or rigidity of the ureteral end. Then it remains to determine the particular kind of kidney trouble.

As to disturbance of the bladder by dislocation of the bladder by tumors, adhesions, and other conditions, I believe that anteflexion of the uterus never produces bladder symptoms, but whether other dislocations will produce symptoms or not, depends on one point, namely, that the female bladder is very adjustable. There may be bladder disturbance in rapidly growing tumors of the uterus or in any condition which develops rapidly, even when the bladder wall is not involved in the inflammatory process.

As to diagnosis of floating kidney, two points should be considered. When the patient resists a thorough examination by contraction of the abdominal walls, it is a good plan to examine the patient in a warm bath. It is astonishing how easily you can examine all the abdominal organs. Next, pass into the ureter of the affected side a sound that will show in an X-ray picture. If the kidney pushes downward, you will find all kinds of curves in the ureter, as shown by the sound. Palpation of the ureters at the lower end is a very important procedure, and Saenger first pointed out how easy it is to do this if you know where to look for the ureters. It is astonishing how often the ureters are mistaken for the round ligaments. The difference in tenderness between the two sides, as pointed out by Dr. Watkins, is also of importance.

DR. W. M. THOMPSON: The term cystitis is used so generally that the average practitioner is apt to be led astray in his diagnosis. I am reminded of two cases I saw this winter. The first patient had frequent micturition, with some pus in the urine. The cystoscope revealed a slight inflammation at the base of the bladder. I tried all means of treatment and finally drained the bladder through the vagina. That gave the patient relief for a time until the fistula closed, when the symptoms returned. There was no prolapse of the bladder; the patient was healthy and vigorous, so that for a time I was inclined to regard the case as one of neurosis. Finally, I examined the abdomen carefully and found that the uterus was not as freely movable as it should be. I operated and found extensive adhesions in both broad ligaments and between the uterus and bladder. When the bladder was emptied, the uterus was slightly movable. I cleaned out the pelvis and the woman is now entirely well.

The second patient had cystitis with slight inflammation in the base of the bladder, a slight prolapse, and a relaxed perineum. She suffered much from constipation and gas in the intestines. I catheterized the ureters and kidneys. The urine was clear, although occasionally there was a little pus. She went to Denver and then to Pittsburg. She saw several good men in both places, but failed

to get any relief. She finally returned to me. On looking over my notes on her case, I found recorded a small cystic ovary on the right side and prolapse of the transverse colon. I performed a laparotomy and found many adhesions between the omentum and bladder; the transverse colon was drawn down, and there was ptosis of the stomach. There were some adhesions in the broad ligaments on both sides. There was no thickening of the tubes. I released the adhesions, removed both tubes and ovaries, and eight days afterwards she had a hæmorrhage into the broad ligament on the right side, probably due to absorption of the catgut. She coughed and sneezed and jumped up in bed and immediately complained of a severe pain in the side. On the following day a tumor was felt which I concluded was due to a hæmorrhage into the broad ligament. This tumor became infected. Her leucocytosis rose from nearly normal to 40,000 and the abdomen was opened again. As a result the adhesions may have returned and she may have bladder symptoms again. This case suggested to me how one might overlook abdominal conditions and regard the case as a neurosis, when really there was a sound pathologic basis for all of the symptoms. A slight inflammation at the base of the bladder is easily relieved by irrigation, but these patients have something more than that the matter with them, and they may suffer more than they would with a large tumor.

DR. WEBSTER (closing): I agree in the main with Dr. Watkins and Dr. Kolischer. We frequently find these conditions without any bladder symptomatology. The bladder adjusts itself to many conditions in a perfectly wonderful way, but when we find such bladder symptoms I cannot believe that they are always due to infection in the bladder. I remember a case I saw in Martin's clinic, in Berlin in 1888; a Russian lady doctor, one of my co-workers. One day she appeared as a patient on the operating table. Martin removed a small fibroid from the anterior wall of her uterus. Previously she had been treated for frequent and painful micturition. There was no cystitis, and there was nothing pathologic in the urine. Martin thought that the symptoms were caused by the pressure of a fibroid. The lady recovered entirely in four or five weeks.

I have seen other cases where the pressure of a small fibroid on the bladder caused frequent micturition and do not think that they are rare. They are not necessarily accompanied with bladder infection.

Dr. Kolischer rightly insisted on the importance of X-ray catheter work in some of these cases. I have had a number of skiagraphs made with the catheter in position. I use the metal silver-wire-wound catheter.

Diseases of the urinary tract provide us with many surprises. Why some cases of traction and pressure are associated with symptoms related to the bladder, while others are not, I do not know. But this is nothing more surprising than we find in cases of pelvic infection. Ordinarily, with a pyosalpinx we expect to find a fairly definite history, and yet, every now and then, we find a pyosalpinx, not tuberculous, without any previous characteristic symptomatology. Some of these patients have no pain. The ureters may sometimes be extensively diseased without definite symptoms. An interesting example is now under my care in the Presbyterian Hospital, a woman who had been under Dr. Billings' observation for several years. She has been in good health during the last two years until within the last few weeks, when she began to complain of backache and a bearing-down feeling. She looks healthy. I examined her and thought she had a double pyosalpinx. There was no particular tenderness, but there was a resistant elastic swelling on each side. There was a little pus in the urine; no tenderness over the ureters. I opened the abdomen and found the broad ligament on each side filled with an enormously enlarged ureter. On the right side it felt like a hydrosalpinx; on the left side it felt exactly like a pancreas.

TUBERCULOSIS OF THE PELVIC VISCERA

BY EFFIE LOBDELL, M. D.

The patient from whom this specimen was removed was eighteen years old, but had never menstruated. Two months before I saw her she was married and shortly after began to have pelvic pains and considerable discomfort. On examination, I discovered a mass projecting down into the vagina from the cervix. I excised a small piece for microscopic examination. It proved to be a tubercular lesion, and a week later I extirpated the uterus, tubes, ovaries, and upper portion of the

vagina, which was involved in the growth. The uterine cavity was entirely closed. There were many adhesions in the cul-de-sac, of the intestines to the uterus and tubes, with many granulations on the intestines and peritoneum.

DISCUSSION

DR. J. CLARENCE WEBSTER: The uterus seems to be of the infantile type. It is only about two inches long, and the cervix is longer than the body. How are the secondary sexual characters?

DR. LOBDELL: The woman was very well developed in every way.

DR. T. J. WATKINS: This specimen was especially interesting in that it would indicate that the tuberculosis was primary in the cervix. It is interesting to know that a tuberculosis of the genital organs is ever primary and not always secondary. The specimen is more suggestive of primary tuberculosis in the cervix than any case I have ever heard of.

DR. CHAS. B. REED: It is interesting to know whether the serum treatment might have been used, or whether radical removal was the only treatment. The serum has been used successfully in many localized conditions.

DR. GUSTAV KOLISCHER: The specimen illustrates another point, namely, that while the general surgeons have frequently recorded in the literature cases of tuberculosis of the vagina, the condition is not recognized by gynecologists. I recall only one published case, that of Friedlaender, from Olshausen's clinic, but even that might have been secondary. So far as the tuberculin treatment is concerned, especially for lesions involving only the cervix, it has been shown that, as in kidney tuberculosis, it is successful only in a very limited number of cases, and that when the tubes are involved, the treatment is without any effect. So that the radical operation is the proper thing to do, provided that there are no lesions of the lungs or elsewhere.

DR. GEORGE SCHMAUCH: The queer form of this growth is interesting, a sort of cauliflower growth, which makes the case a very rare one. The only form of tuberculosis similar to this is tuberculosis verrucosa of the skin.

DR. LOBDELL: I made a comparative study of this case with one of specific invasion seen a few months previously. It was a tumor of the cervix which subsided promptly under anti-specific treatment. I did not try the serum treatment or any other form of treatment in this case, mainly because the patient could not be controlled very well. It was almost impossible to keep her in the hospital after the original examination was made, because she was so very well. Therefore, it was deemed advisable to do something which in this particular case would do the surest good.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF SURGERY

UNDER THE CHARGE OF

FREDERIC A. BESLEY, M. D.

GEORGE E. BEILBY, M. D. — WM. R. CUBBINS, M. D. — AIMÉ PAUL HEINECK, M. D.
WM. C. DANFORTH, M. D. — FREDERICK G. DYAS, M. D. — G. T. COURTENAY, M. D.
FRED C. ZAPFFE, M. D. — JAMES F. CHURCHILL, M. D. — B. J. O'NEILL, M. D.
ARTHUR B. EUSTACE, M. D. — JOHN A. WOLFER, M. D. — H. A. POTTS, M. D.

The Nature of the Effect of Gastroenterostomy (Die Wirkungsweise der Gastroenterostomie). A. PERS. *Nord. Med. Arkiv.*, 1909, b. xlii (Kirurgi), h. 1 and 2, Nr. 2.

Pers tested on human beings the work done by Cannon and Blake and Leggett and Maury on dogs. His material consisted of forty cases which had previously undergone the operation for gastroenterostomy for benign conditions from one month to six years. Of these cases seventeen showed stenosis due to scar formation; seventeen spastic condition due to ulcer; two duodenal ulcer; one each ulcer of the lesser curvature, ulcer of the pylorus and bilocular stomach, and gastroptosis. After carefully examining normal individuals with bismuth solutions and the X-ray, Pers determined the normal. Using the same method with his cases he found that in thirty-eight food passed only through the gastroenterostomy opening, in one case a small part passed through the pylorus, and in one case the course could not be determined. Of the thirty-eight cases fifteen represented a type where the food passed into the pyloric portion of the stomach, remained some time and then passed through the gastroenterostomy opening; in fifteen the food passed into the pyloric portion, remained but a short time and then passed through the opening; while in eight cases the food passed directly through without going into the pyloric portion. Pers thinks, therefore, that he is justified in concluding that the food practically always leaves the stomach by the anastomatic opening.

C. G. GRULEE.

Pathology of Appendix Inflammation (Über das Segmentäre bei der Wurmfortsatzentzündung). WILHELM BRÜNN. *Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, vol. xxi, No. 1, p. 1.

The author is of the opinion that inflammation of the appendix is due primarily to some interference with the normal circulation in the blood-vessels of the mesentery of the appendix, and that it is a mixture of acute inflammation, hæmorrhagic infarction, and stasis. Whether or not this is due to a bacterial invasion, he is not prepared to say, but as the result of extensive clinical observation and experimental research he is led to say that if the mesenteric artery of the appendix is ligated for two or three hours and the ligature is then removed, acute inflammation and hæmorrhagic infarction will take place in the end arteries in the appendical mucosa. If the circulation is obstructed for a longer period, the pathologic process will extend deeper into the wall of the appendix, the depth of such extension being dependent entirely on the duration of the vessel obstruction. Curiously enough, the lesions were seen to occur only in the areas supplied by these vessels and did not extend over the entire surface of the mucosa. That is a segmentary inflammation, as the author terms it. He says that while he does not wish to be understood as claiming that spasm of the blood-vessels invariably produces an attack of the appendix, it is nevertheless significant that it plays quite a rôle in its causation.

FRED C. ZAPFFE.

Diagnosis and Treatment of Acute Inflammation of the Upper Abdomen. A. W. MAYO ROBSON. *British Medical Journal*, January 10, 1910.

After taking up briefly the general etiological factors and presenting a graphical clinical picture of the typical cases, the author considers the more important points in the diagnosis and treatment, which in brief are as follows:

As to diagnosis. High appendicitis. Pain in the region of the liver, but rigidity and tenderness most pronounced in the appendical region. Cholecystitis. History of ancient attacks is important. Absence of jaundice not a factor. Gall-bladder may be obscured by enlarged liver. Perforated duodenal ulcer. Suppuration indicates subacute perforation. In most cases pain in region of appendix. Acute pancreatitis. History of gall-stones; urinary reaction; fat necrosis. Jejunal ulcers. Almost always dependent on previous peptic ulcer and post-operative in character.

After treatment. Particular points brought out are:

In the cases diagnosed as high appendicitis, the benefit of a long vertical incision, preferably one inch to the right of the median line, thus permitting of a thorough exploration and limiting the dangers of hernia. The advantages of cholecystostomy over cholecystectomy, the latter only to be used in gangrenous and similar perforated cases as a rule.

Suturing of perforated peptic ulcers without gastroenterostomy, unless in the presence of a severe pyloric

obstruction. Drainage of lesser peritoneum in acute pancreatitis. Cancerous suppuration as a contra-indication to any radical measures. Value of surgical interference in acute gastric dilatation.

The principles of treatment of this class of disorders as outlined by the author may be summed up as follows: prompt surgical interference; free incision and drainage; and careful post-operative treatment.

GORDON T. COURTENAY.

Observations on the Course and Outcome of Kidney Tuberculosis (Beobachtungen über Verlauf und Ausgang der Nierentuberkulose in einer Anzahl vorgeschrittener, der Mehrzahl nach nicht operierter Fälle). G. EKEHORN. *Nord. Med. Arkiv.*, 1909, b. xlii (Kirurgi), h. 1 and 2, Nr. 3.

This study is based on thirty-three cases divided as follows: Four cases of advanced tuberculosis of the kidney still living and not seen after leaving the hospital; eight cases still under observation; five cases dead without post-mortem; ten cases dead with post-mortem; six advanced cases operated. The report is meant to show the ultimate result of untreated tuberculosis of the kidney. The course of the disease when uninterrupted is on the average about six years. Pathologically two types were predominant, the ulcerative, which eventually left a lobulated sac filled with detritus, and a sclerosing type where the kidney was very markedly contracted.

In regard to the localized tuberculosis of the kidney, Ekehorn asserts that the pelvis of the kidney is anatomically divided into an upper, lower, and intermediate compartment, the divisions being more defined in some cases than in others. Where the tuberculosis is localized it corresponds to one of these divisions. Ekehorn thinks that one conclusion to be drawn from his statistics is that each case should be operated when diagnosis is made, although a case may rarely heal out through sclerotic change in the kidney, and healing of ureter and bladder lesions. C. G. GRULEE.

Remarks Concerning the Variations in Viscosity Due to Surgical Operations (Untersuchungen über Änderungen in der Blutviskositæ infolge von Chirurgischen Operationen). GUISEPPE BOLOGNESI. *Zentralblatt f. Chir.*, No. 34, 1909.

Observations Concerning the Blood Viscosity in Surgical Diseases and Operations (Untersuchungen über Blutviskosität bei Chirurgischen Kronkheiten und Operationen). WALTER MÜLLER. *Zentralblatt f. Chirurgie*, No. 41, 1909.

The clinical observations of Bolognesi were made with a Hess viscosimeter on surgical patients before and after operation. Care was taken that the diet should be such that it would not influence the results. Determinations were made 24, 48, and 56 hours before, and six to forty-eight hours after operation.

Hess has fixed the normal average at 4.6, when his instrument is used. The cases were of all types, infections, malignancy, hernias, etc. B. found the viscosity to range from 4.4 to 5.9 before, and from 4.8 to 6.6 after operation, an average rise of 0.6.

He observed usually a rise in temperature and leucocytes, but not always, and, in some cases a rise in these was accompanied by a fall in viscosity, and vice versa — showing that the viscosity does not depend upon the leucocytes.

B. mentions that certain physiological conditions (old age and meat diet) as well as certain pathological processes, such as gangrene and infections, cause a rise in viscosity. The author fancied that the various anæsthetics used had no influence on the changes in viscosity. A table is given showing the changes in viscosity, temperature, and leucocytes before and after operation, in each case.

Müller's conclusions are based upon about 1,050 observations made upon 230 surgical patients. The viscosity of the blood depends upon:

1. The number and hæmaglobin content of the erythrocytes.

2. The albumen content of the serum. (The salts of the blood play no part.)

After aseptic, intraperitoneal operations, he noted the following changes in the viscosity which follow a fairly regular curve:

1. A post-operative rise reaching the maximum at the end of about twenty-four hours.

2. A gradual fall, during the next two or three days, to normal.

3. A further fall during the next two or three days below normal.

4. A secondary rise to normal The changes occupy a period of from six to eight days.

These changes accompany a proportionate rise and fall in the number of red cells and their hæmaglobin content. There is usually an accompanying change in the number of leucocytes, but this does not affect the viscosity. The cause of the erythrocyte increase is probably a stimulation of the blood forming organs by the operation, not by the anæsthetic.

Traumas and acute infections of the soft parts are shown to have the same effect on the viscosity. In chronic infections, a rise in viscosity does not occur — a fall being the rule. Acute peritoneal infections, chronic peritonitis, chronic bone infections, cause a fall in viscosity.

In patients with an already high viscosity, there may be a still further post-operative rise. The usual rise may be absent after very severe prolonged operations.

Increase in the viscosity is noticed after acute intestinal obstruction, but is hardly influenced by loss of fluid by perspiration or cathorsis. The observations were made with a Hess viscosimeter.

J. F. CHURCHILL.

Gastroenterostomy or Resection in Ulcus Ventriculi (Gastroenterostomie oder Resektion bei Ulcus Ventriculi). HOCHENEGG. *Wiener Klinische Wochenschrift*, b. xxiii, 52.

Hochenegg believes that gastroenterestomy is much less dangerous than is resection, that it brings about a cessation of the symptoms whether ulcer is located near the pylorus or in the fundus, and that it is a better protection against recurrence. C. G. GRULEE.

Analysis of 197 Cases of Duodenal Ulcer Operated upon by Mr. Moynihan, 1900-1908. HAROLD COLLINSON. *Proc. Roy. Soc. Med.*, 1910, iii, Surgical Section, 79.

A statistical review. Eleven cases of perforating ulcer, three deaths; one hundred and eighty-six cases chronic ulcer, one hundred and thirty-nine cases of duodenal ulcer alone, forty-seven cases of both gastric and duodenal ucler. One hundred and thirty-one cases between years of twenty and fifty. Hæmorrhage was present at some stage in 37.6 per cent. Tetany in three cases. Cardiospasm in three cases. Seventy-eight were treated by posterior gastroenterostomy with simple suture and eighty-four cases with infolding of ulcer and posterior gastroenterostomy, on the others various operative measures were resorted to.

Mortality, 2.15 per cent. Four other patients have since died of various causes, 79 per cent were cured. Post-operative vomiting occurred in twelve cases.

C. G. GRULEE.

A Pessary for Prolapse of the Rectum (Contención del Prolapso Rectal). E. MONTURIOL. *Archivo de Ginecopatía, Obstetricia, y Pediatria*, October 10, 1909.

The author uses the following improvised pessary in cases of rectal prolapse in children.

A rubber tube about 8 to 10 cm. long and 2 cm. in diameter is used; one end is carefully trimmed of all sharp edges; to the other end are sewed two short bandages. After reduction of the prolapse this tube is inserted, smooth end first, and the bandages passed up in front and behind the thighs and fastened to an abdominal binder. A wooden obturator is then inserted, a hole in its outer end allowing it to be fastened to the binder by a third bandage. This obturator prevents the constant escape of gas and fæces and can be removed for defecation. After a day or two the child becomes accustomed to the apparatus and is able to run about without any great inconvenience from its presence. The tube is changed every day or two, different lengths being used to prevent constant chafing of the same part of the mucosa.

The author reports several complete and permanent cures from the use of this pessary. B. J. O'NEILL.

An Experimental Study of Opsonic Immunity to Staphylococcus Aureus. J. C. MEAKIUS. *Journal of Experimental Medicine*, xii, 67–81.

The writer conducts a series of experiments on rabbits and finds that the phagocytosis of animals treated with staphylococcus aureus vaccine is markedly increased over that of those treated with normal serum. The animals treated with vaccine, and then inoculated with virulent staphylococci, live much longer than those not treated with the vaccine. Those treated with the vaccine lived from 5 to 45 days while those not treated all died within 36 hours. Also shows that "opsonins produced by vaccination with one strain of staphylococcus aureus are very powerful in promoting a phagocystosis of heterologous strains, but have a somewhat greater power against the homologous strains."

He recites two human cases with good results as result of the vaccine treatment.

Conclusions:

1. The administration of the staphylococcus aureus killed by heat (vaccine) produces a high degree of opsonic immunity in rabbits.

2. Such increase of opsonins affords protection against the living virulent staphylococci in direct proportion to the amount of opsonins present in the serum and complete recovery may follow subsequent inoculation if the opsonic power be high.

3. Frequent administration of vaccine may produce a diminution of the opsonic power of the serum.

4. Immune opsonins are most active against the homologous strains of staphylococcus aureus but are only slightly less active against heterologous strains.

5. Infections of the human body by staphylococcus aureus may cause great increase of opsonins.

6. Vacinnes prepared from staphylococcus aureus may produce a high degree of opsonic immunity in man.

JOHN A. WOLFER.

Remarks on Appendix Dyspepsia. B. G. A. MOYNIHAN. *British Medical Journal*, January 29, 1910.

In a very interesting article Mr. Moynihan discusses a class of cases commonly known as "dyspepsia," and usually diagnosed as a disorder of the stomach — frequently gastric ulcer. He points out the fact that careful study of and operation upon a number of these patients has revealed nothing but a chronic adherent appendix, often accompanied by pyloric spasm, which he thinks to be of a reflex nature.

Removal of the appendix has been accompanied by recovery.

In a typical case of this type there is a history of pain, usually occurring about an hour after eating, located in the epigastrium, and with no interval of relief. Vomiting is common and may be bloody, and the stomach contents show increased H. Cl. Often there is tenderness over the pylorus. The history dates over a long period of time.

The author finally concludes:

1. Symptoms of gastric or duodenal ulcer, especially the former, may be exhibited in cases manifesting no structural charge.

2. In many cases of so-called gastric ulcer or dyspepsia the only pathological change at operation is a chronic appendix.

3. Its removal brings relief.

4. No operation for gastric ulcer is complete without thorough abdominal search.

5. Where no stomach lesion is found, do not perform gastroenterostomy.

6. Mimicry of symptoms is due to pyloric spasm.

7. Investigation is necessary to determine frequency with which mucous erosion of stomach is dependent upon appendix or intestine. Several cases are reported.

GORDON T. COURTENAY.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF GYNECOLOGY

UNDER THE CHARGE OF

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J. C. HOLLISTER, M. D.
GERRY R. HOLDEN, M. D.
E. C. DUDLEY, M. D.
GEO. DE TARNOWSKY, M. D.
CAREY CULBERTSON, M. D.

The Removal of Extremely Large Tumors of the Small Pelvis by Means of Resection of the Ramus of the Pubes and the Symphysis (Die Entfernung Übergrosser Tumoren des Kleinen Beckeus mit Resektion des Schambeins und der Symphyse). PROF. HERMANN KUTTNER. *Beiträge zur Klinischen Chirurgie*, bd. 60.

Küttner reports two cases of very large tumors impacted in the pelvis, which he was enabled to remove by resection of the pubic rami. One of these was a subperitoneal fibroma, the other a pelvic enchondroma, both of them being larger than the adult head.

In the operation for fibroma the entire symphysis as well as a portion of the right pubic bone and ramus were resected. In this case also a portion of the bladder was resected on account of adhesions to the tumor. In the case of the enchondroma, a portion of the pubes 2–3 cm. wide was excised. In both cases a simple cutting through of the pubis, or hebotomy, did not suffice to give access to the tumors, so that a resection had to be made. The neoplasms were extirpated by morcellement. The pelvic defects were allowed to remain. The interesting feature is, as Küttner states, that, in spite of the amount of bone removed, the patients did not show any change in their ability to walk. The woman from whom the greater portion of bone was removed was able to stand upon the leg of the resected side. The functions of the pelvic organs were not disturbed. Küttner presents the cases as a suggestion as to increasing the accessibility of such new growths. W. C. DANFORTH.

Gelatinous Cystomas of the Ovary and the Gelatinous Peritoneal Changes Occurring in their Rupture, *Pseudomyxoma peritonei* (Über die Gallert kystome der Ovarien und die bei Ruptur auftretenden gallertigen Veräunderungen des Bauchfells s. g. *Pseudomyxoma peritonei*). E. AHLSTRÖM. *Nord. Med. Arkiv.*, 1909, b. xlii (Kirurgi), h. 1 and 2, Nr. 1.

After an exhaustive review of the literature Ahlström reports twenty-eight cases from the Scandinavian clinics, in nine of which complete microscopical reports are given, in the other nineteen the clinical observations are given and in three of these microscopical report of the original tumor.

In taking up the pathology of the condition he makes many interesting observations. Among his opinions may be mentioned the following:

In the secondary tumors occurring in the peritoneum and elsewhere the epithelium quickly degenerates. The gelatinous cystoma is an entity distinct from the pseudomucincystoma. The so-called myxomatous degeneration is really an invasion of the connective tissue by the gelatinous substance to which the connective tissue offers little resistance, and as a consequence is destroyed. Rupture of these cysts is brought about by two factors: (1) the wall is thin and poor in elastic tissue, (2) the invasion of the wall by the gelatinous substance. The gelatinous cystoma of the ovary is frequently bilateral and is intraligamentous in 20 per cent of the cases.

In a majority of the cases the peritoneum is the seat of larger or smaller gelatinous tumors. In most of the cases the changes in the omentum are not on the surface but in the substance and are likely due to the penetration of the gelatinous substance into the lymph spaces of that organ. Gelatinous masses may act in the peritoneum like foreign bodies being enveloped in a connective tissue capsule, but the connective tissue capsule is rich in cells and blood-vessels and not like the connective tissue of the cyst wall. Epithelial metastases are present in the peritoneum in at least 50 per cent of the cases. The epithelium of the metastases exerts a specific influence on the connective tissue surrounding it rendering it similar to that of the original tumor. Non-striated muscle also shows this same lessened resistance. In one of his cases (case 5) the lymph glands of the abdominal cavity, above the diaphragm, and in the inguinal region, were invaded by metastases. (The only case on record.) He thinks that the subperitoneal metastases are formed in two ways: (1) by direct sucking of the epithelium into the lymph spaces and (2) by the growth of the epithelial cysts deeper into the tissues. In three of the cases metastases occurred in the appendix. It is not possible to say whether the cyst occurring in the other ovary is an implantation cyst or a new growth.

In 84.4 per cent of his cases and those collected from the literature, the patients were over forty years of age. In 75 per cent of the cases the clinical symptoms were less than a year in developing. Rupture is attended by no suddenly occurring subjective symptoms. Of

Ahlström's cases (twenty-eight primary and five secondary ovariotomies) four died (1 operation undertaken as a palliative measure). Deaths due to purulent peritonitis, 1; ileus, 1; and acute nephritis, 1. Of those cases having epithelial metastases at least a third show increase of these tumors.

Late recurrences are not rare, one coming after nearly ten years, therefore a cure cannot be pronounced three years after ovariotomy even if the patient shows no sign of recurrence. In 38 per cent of his cases (twenty-one cases reckoned) the patients remained well after six years. In those cases where only deposits of the gelatinous substance are found the prognosis is good, but if macroscopic gelatinous cysts remain the prognosis is doubtful if not altogether bad.

Ahlström believes to have established that the "organization" process is a healing process while in the formation of the epithelial metastases the true danger lies.

The article is really a monograph on the subject and justice cannot be done it in the space of a short abstract. C. G. GRULEE.

Bacteriological Researches Anent the Applicability of Tincture of Iodine as a Skin Disinfectant (Recerche Bacteriologiche sulla applicabilita della tintina d'Iodio, quale disinfettante della cute). DR. ATTILIO LOIACONO. *La Genecologia Moderna*, September, 1909.

Loiacono conducted a series of experiments with a 12 per cent alcoholic solution of tr. iodine in order to determine its penetrability and antiseptic power on the skin, guinea pigs were used, sections of their skin being made and examined histologically. In one series of cases the skin was first shaved, then scrubbed with soap and water followed by alcohol and ether; in a second series the skin was merely dry shaved and the tr. iodine applied immediately without any further disinfection. In both series it was found that there was equal penetration, involving only the epidermal stratum.

Desirous of finding a solution having greater penetrability, Loiacono conducted a third series of experiments on guinea pigs, using a solution of equal parts of alcohol and acetone with 12 per cent iodine.

RESULTS

Tr. iodine alone. Penetration of epidermis slower.

Tr. iodine in alcohol-acetone. Complete penetration of entire cutis with diffusion throughout the subcutaneous tissues.

Bacteriological investigations were not carried out in order to determine the effect of iodine-alcohol-acetone on bacteria found in the skin. The results showed that the solution had no inhibitory power on bacterial growth.

The influence of the iodine-alcohol-acetone solution in the prevention of bacterial growth was also negative in a series of cases in which b. prodigiosus, b. pyocyaneus and staphylococcus were artificially implanted in the skins of monkeys and guinea pigs. Loiacono concludes from his researches that:

1. The disinfection of normal epidermis by means of iodine or iodine-acetone, as regards the destruction of pre-existing bacteria, is impossible.

2. The destruction of bacteria artificially added to the epidermis is only partially complete.

3. The use of tr. iodine may in certain cases tend to diffuse infection.

4. Of clinical importance is the fact that certain bacteria such as the bacillus diphtheriæ, while destroyed in culture-media by tr. iodine, are only slightly or not at all affected by the same solution when growing on the epidermis. GEORGE DE TARNOWSKY.

Mammin Pohl, a New Treatment of Fibromyoma and Chronic Inflammation of the Uterus (Mammin Pohl als neue Behandlungs-methode bei Fibromyomen und chronische Entzundungen der Gebarmutter). DR. MEKERTTSCHIANTZ. *Monats. f. Geb. u. Gyn.*, b. xxxi, h. 1.

Mammin pohl is not a chemical unity but a synergic group of substances of the mammary glands. It differs from other mammary preparations in not containing toxic substances.

After using this preparation in 26 cases the author concludes:

1. Given per mouth in tablets of 8 to 10 grains 2 to 6 times daily with meals, mammin pohl will produce diminution of the fibroma; it stops or diminishes hæmorrhages, regulates menstruation, strengthens the body. Its use is a rational, therapeutic method.

2. Every fibromyoma ought to be treated at least 1 to 2 months if immediate operation is not indicated, and operation only resorted to if the drug is not effective. In cases of heart trouble, Bright's disease, or other contraindications to operation, it is the only rational treatment.

3. In cases of chronic metritis it will remove congestion of the uterus, produce contraction of its muscles, it regulates the menstruation, decreases pain and fluo, and improves the general condition.

4. In some cases the subcutaneous application becomes necessary. Some patients took the drug over one year without harm. HELIODOR SCHILLER.

A Case of Gangrene of the Leg Following Abdominal Hysterectomy (Un Caso de Gangrena de la Extremidad Inferior Despues de una Histerectomia Abdominal). DR. GUILLERMO RIBAS. *Revista de Medicina Cirujia, Barcelona*, December, 1909.

A woman of 26, otherwise in good general condition, was suffering with double pyosalpinx, which continued to grow worse with palliative treatment, so that an operation was finally made in spite of a temperature running about 39 C. The conditions were found to be such as to necessitate removal of the uterus and adnexa. Three days later the patient began to have severe pains in the toes of the left foot, followed by a slowly develing progressive dry gangrene, making amputation necessary five weeks later. An acute nephritis developoped and the patient died with uræmic symptoms ten days after the amputation. The cause of the gangrene was found to be an infective endarteritis.

B. J. O'NEILL.